



SALMON SPAWNING GROUND SURVEYS IN BRISTOL BAY, 1985

Edited by:

Wesley A. Bucher

February 1987

ADF&G TECHNICAL DATA REPORTS

This series of reports is designed to facilitate prompt reporting of data from studies conducted by the Alaska Department of Fish and Game, especially studies which may be of direct and immediate interest to scientists of other agencies.

The primary purpose of these reports is presentation of data. Description of programs and data collection methods is included only to the extent required for interpretation of the data. Analysis is generally limited to that necessary for clarification of data collection methods and interpretation of the basic data. No attempt is made in these reports to present analysis of the data relative to its ultimate or intended use.

Data presented in these reports is intended to be final, however, some revisions may occasionally be necessary. Minor revision will be made via errata sheets. Major revisions will be made in the form of revised reports.

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FOREWORD

Aerial surveys of salmon spawning grounds have been conducted in Bristol Bay for nearly 40 years to determine the distribution and abundance of salmon escapements. This information is useful to fishery managers for a variety of reasons but most important is the documentation of escapement size to those river systems where counting towers are not maintained.

In past years, results from these surveys have been documented in different formats and styles primarily due to the difference in survey techniques and the methods by which the data is analyzed. This report represents our continued effort to publish survey results from all districts under one cover. In future years it is our intent to standardize techniques and methodology, wherever possible, so that the data is more directly comparable and therefore more meaningful.

ABSTRACT

Results of aerial enumeration of salmon spawning populations are summarized by species and area for five major river drainages in Bristol Bay. Methods used to survey salmon spawning grounds are presented. Surveys have been conducted in a like manner for 40 years in some areas and yearly estimates of spawning populations are compared for the years 1966-1985 where the data base allows. In Nushagak and Togiak Districts, comprehensive aerial surveys form the basis for expanding peak aerial live counts (indices) into total population estimates. In the districts without historic comparative data, only index counts are presented.

KEY WORDS: Aerial surveys, salmon spawning population, distribution, abundance, escapement.

1985 SPAWNING GROUND SURVEYS IN NUSHAGAK AND TOGIAC DISTRICTS

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INTRODUCTION

Aerial surveys of salmon spawning grounds were conducted in 1985 continuing a program initiated in 1956 to determine distribution and abundance of salmon escapements. Survey coverage was limited to those river systems in Nushagak and Togiak Districts where no other types of escapement estimates were made or where distribution of the spawning populations was of concern (Figures 1-7).

Four species of salmon were encountered in the 1985 surveys. Chinook, chum, sockeye, and coho salmon were counted in the Togiak District, while only chinook and sockeye salmon were counted in the Nushagak District. Weather conditions allowed completion of most surveys on or near peak of spawning, although high and turbid water conditions precluded surveys in important areas of the upper Nushagak-Mulchatna drainage.

METHODS

Aerial survey methods employed in 1985 were comparable to those in past years. Methods and procedures are documented in Appendix A of Bristol Bay Data Report No. 73 (Nelson 1979).

All survey flights were made in a Cessna 185 wheeled aircraft, equipped with a bubble window. The fish were counted from an altitude of 200-400 feet and the same pilot, experienced in aerial surveys, was used on all flights. This was my seventh year of flying escapement surveys and I was the only observer in the aircraft.

After analysis and summarization of peak aerial live counts, total population estimates were derived for each species and area. Analysis of escapement data was consistent with past years, although methods varied according to species and area surveyed (Nelson 1979).

It is widely recognized that aerial spawning ground surveys account for only a portion of the known spawning populations (Evzerov 1975; Nelson and Geen 1981; Rogers 1984). At the time of each survey, some of the fish have yet to reach the spawning grounds, some have spawned and died, some are schooled (thus, unobservable), while others are misidentified, etc. Because

FIGURE 1.
Location of river systems in
Nushagak and Togiak districts
where aerial spawning ground
surveys were conducted, 1985.

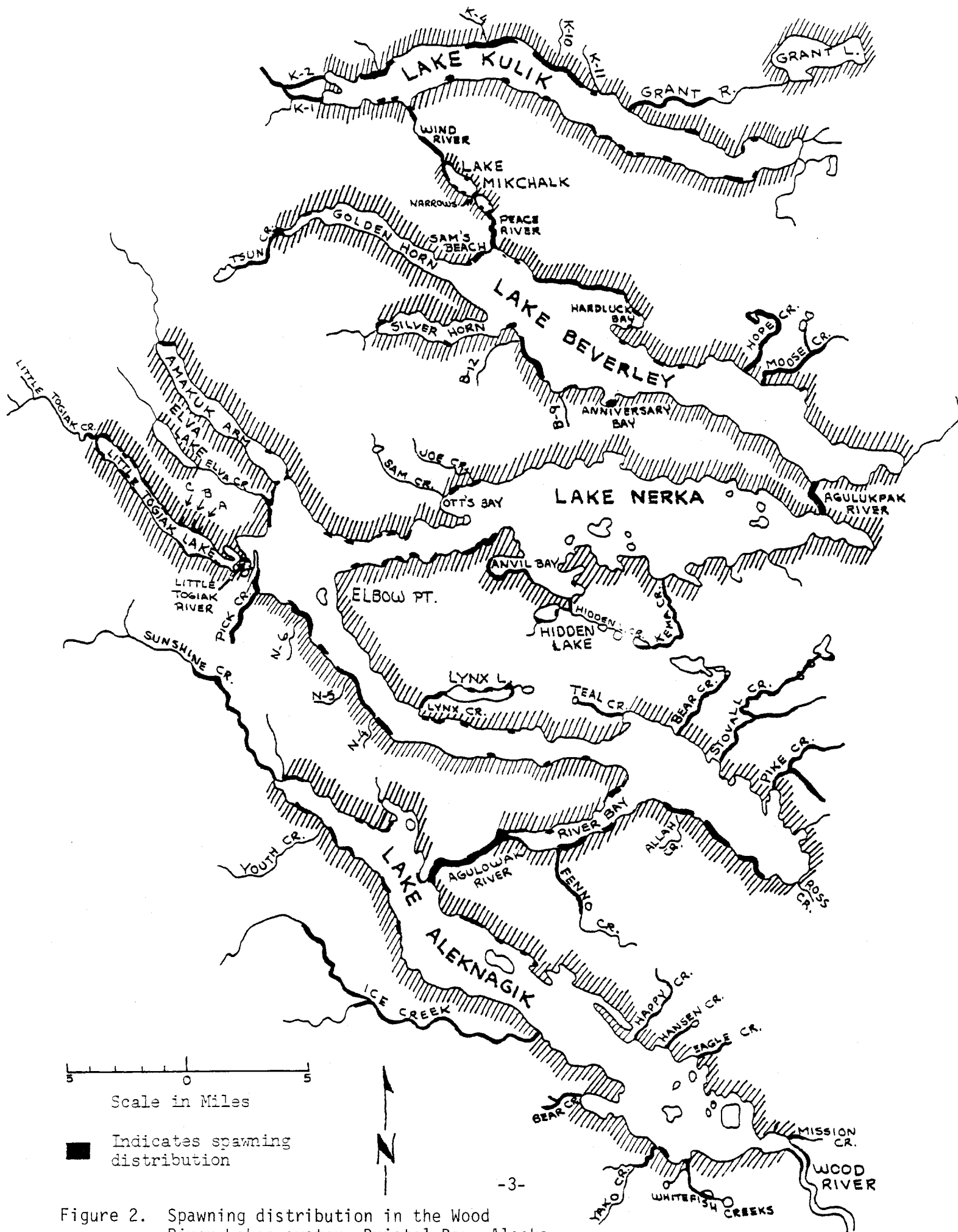


Figure 2. Spawning distribution in the Wood River Lakes system, Bristol Bay, Alaska.

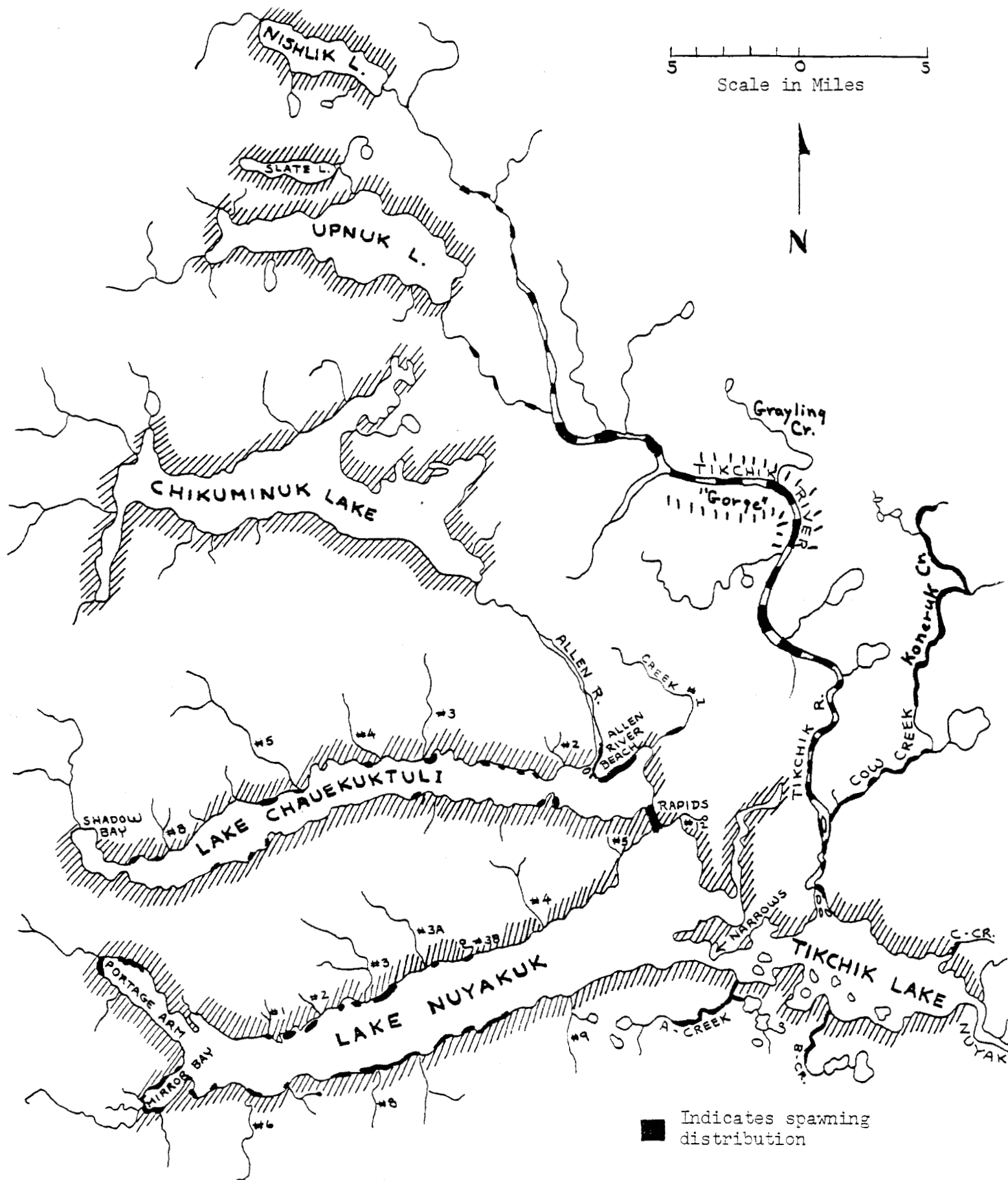


Figure 3. Spawning distribution in the Tikchik Lakes system, Bristol Bay, Alaska.

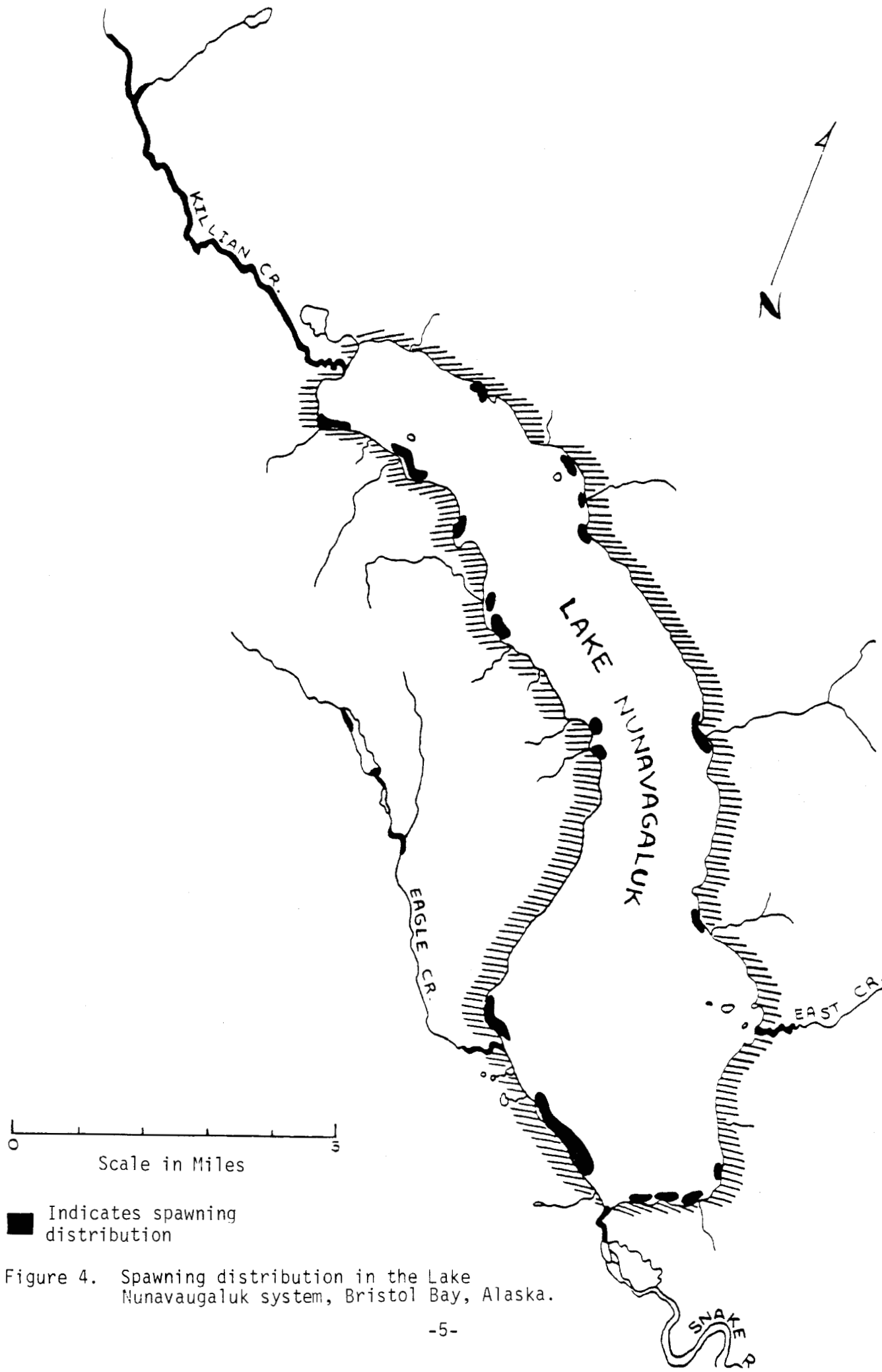


Figure 4. Spawning distribution in the Lake Nunavagaluk system, Bristol Bay, Alaska.

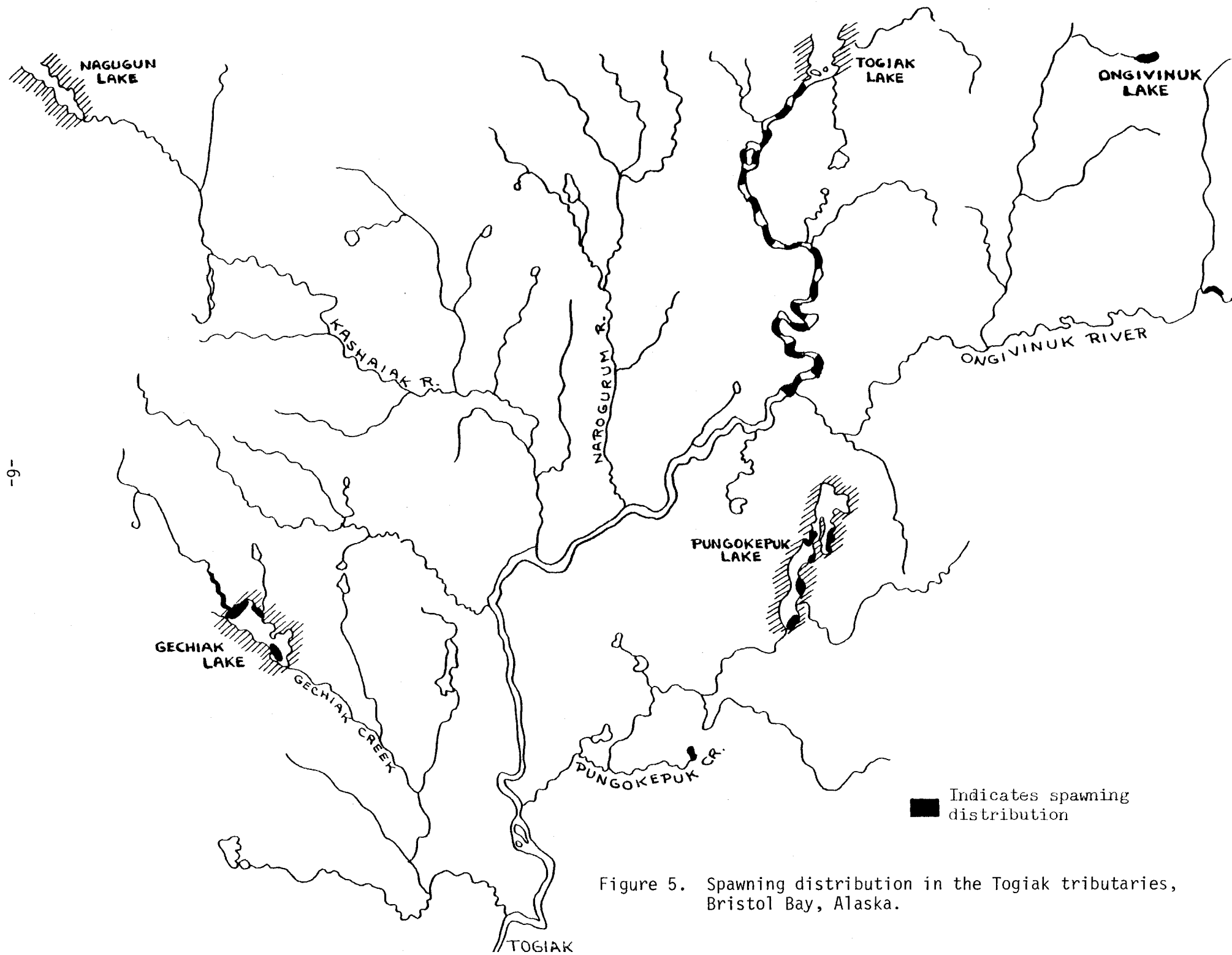


Figure 5. Spawning distribution in the Togiak tributaries, Bristol Bay, Alaska.

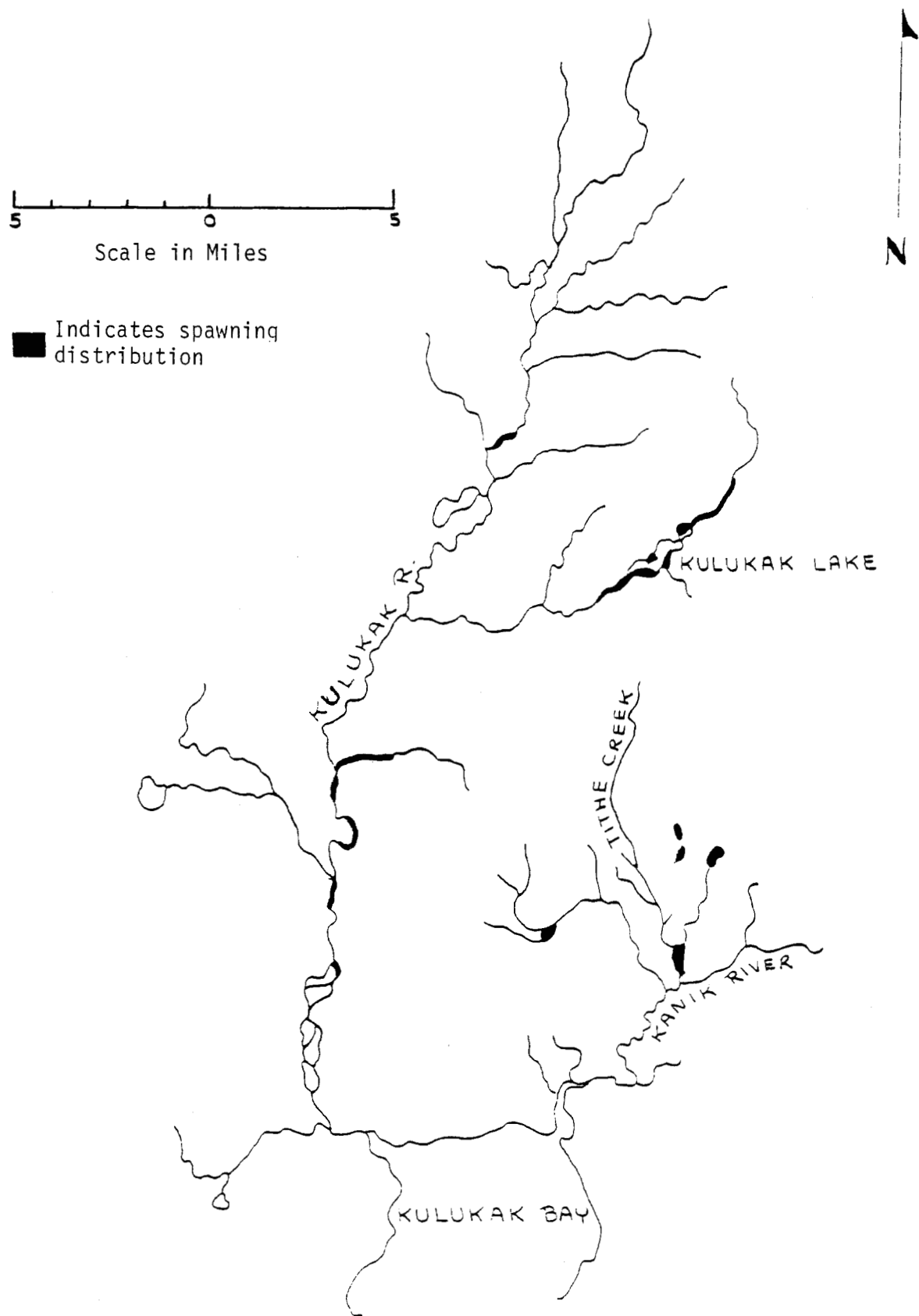
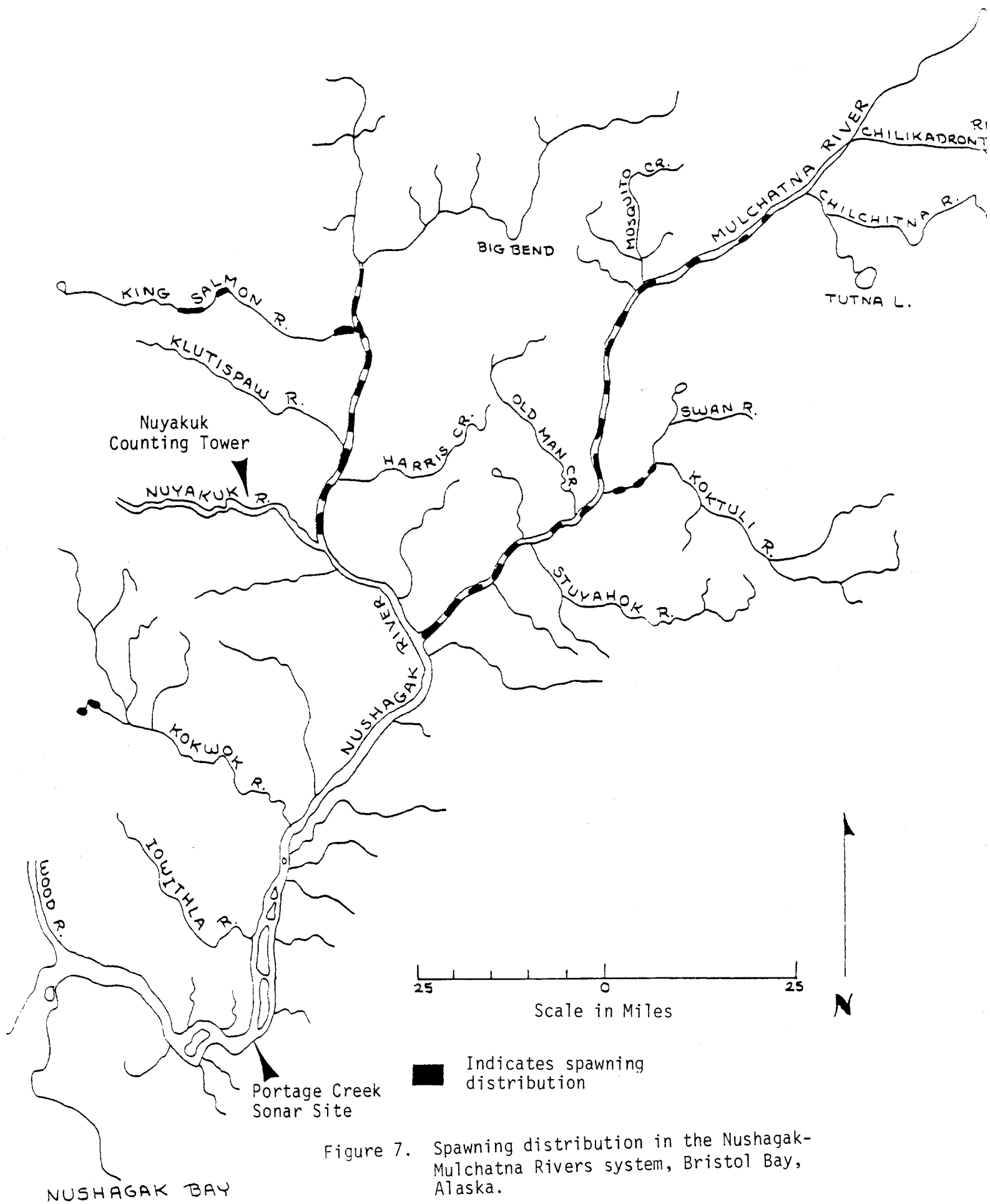


Figure 6. Spawning distribution in the Kulukak Lake system, Bristol Bay, Alaska.



independent estimates of sockeye salmon escapements have been made from counting towers at lake system outlets for a number of years in Bristol Bay, it has been possible to compare aerial survey estimates with the tower counts which have been found to have a 5% mean absolute error. These comparisons have indicated that the number of sockeye salmon accounted for by aerial survey averaged about 50% for over 20 years (Nelson 1979), which was the basis for expanding peak aerial live counts reported here. Variable expansion factors were applied as necessary to each species and area surveyed which allowed a closer approximation of the total spawning population. Weather and water conditions encountered during the surveys, as well as the relative timing of each survey affected survey accuracy, and the expansion factor was adjusted to compensate for these variable conditions.

RESULTS

Sockeye Salmon

Aerial surveys of sockeye salmon were conducted in the Wood River Lakes to determine spawner distribution and abundance by major spawning area (Figure 2). Lake Nunavaugluk in the Nushagak District (Figure 4), the Togiak River and its tributaries (Figure 5), the Kulukak River and Tithe Creek Ponds within Togiak District (Figure 6) were all flown to determine the actual spawning escapement. Sockeye salmon were also enumerated in the Nushagak-Mulchatna River system, however, these surveys were timed to coincide with the peak of chinook salmon spawning. Generally these surveys were earlier than the peak of sockeye salmon spawning, but still provided a good representation of sockeye salmon escapements to the system.

Wood River Lakes System:

Peak aerial escapement estimates of sockeye salmon for the Wood River system in 1985 are presented by area in Table 1 along with total population estimates. Because the counting tower on Wood River (outlet of Lake Aleknagik) provides an accurate total escapement estimate to the system, aerial surveys were flown only to obtain population estimates by major spawning area (Figure 2). The aerial surveys did not represent the entire spawning population, but accounted for only about 50-65% of the total. Thus peak aerial live counts for each area were adjusted to reflect the actual number of fish present and made to total the escapement estimate from the counting tower.

Table 2 compares the 1985 population estimates with the 40-year summary for each major area. The total 1985 escapement of 939,000 sockeye salmon to the Wood River system was only 11% (121,300 fish) less than the 1946-1985 average of 1,060,300.

Although escapement to this system met the goal, spawning distribution was again poor, as it was in 1984. Nearly 50% of the total escapement was observed in the Agulupak River while only 7% occurred in the Agulowak River. This pattern was unusual in that, even in past years with heavy river escapements, the Agulowak River has accounted for the bulk of the river spawning fish. Table 3 shows the percentage distribution of spawning sockeye salmon in the three major types of spawning areas for the period 1959-1985.

Table 1. Peak aerial live counts and total population estimates of sockeye salmon on the spawning grounds, Wood River Lakes, 1985.

Area	Aerial Counts 1/		Total Population Estimate	
	Date	Number	Number	Percent
Wood River	8/26	5,200	7,800	0.83
<u>LAKE ALEKNAGIK</u>				
Eagle Creek	8/ 4	460 2/		
Hansen Creek	8/ 4	300 2/		
Happy Creek	8/ 8	3,510 2/		
Bear Creek	8/ 7	3,950 2/		
Yako Creek	8/ 3	1,350 2/		
Whitefish Creeks	8/12	760 2/		
Ice Creek	8/ 6	7,300		
Mission Creek	8/13	240 2/		
Sunshine Cr.	8/ 6	3,200		
Northshore Beaches	8/26	2,700		
Southshore Beaches	8/26	1,000		
Yako Beach	8/26	1,200		
Youth Creek	-	-		
TOTAL		25,970	101,000	10.76
Agulowak River and Lower River Bay	8/26	50,000	74,800	7.97
<u>LAKE NERKA</u>				
Fenno Creek	8/ 6	2,300		
Upper River Bay Beaches, N.W.	8/26	100		
Upper River Bay Beaches, S.E.	8/26	1,300		
Allan Cr. to Ross Cr. Beaches	8/26	1,200		
Pike Creek	8/16	2,000		
Stovall Creek	8/16	1,000		
Stovall Lake Beaches	8/16	0		
Bear Creek	8/16	200		
Bear Creek Lake Beaches	8/16	0		
Teal Creek	8/16	0		
N4-N6 Beach to River Bay Beaches	8/26	2,600		
Pick Creek Beach	8/26	3,200		
Pick Creek	8/16	9,300		
Elva Creek Beach	8/26	1,500		
Elva Creek	8/24	160 2/		
Amakuk Arm Beaches	8/26	1,030		
Amakuk Arm Beach to Ott's Bay Beach	8/26	2,110		
Ott's Bay Beaches	8/26	1,900		
Kema Creek	8/16	2,400		
Kema Creek Lake Beaches	8/16	0		

-Continued-

Table 1. Peak aerial live counts and total population estimates of sockeye salmon on the spawning grounds, Wood River Lakes, 1985 (continued).

Area	Aerial Counts		Total Population Estimate	
	Date	Number	Number	Percent
<u>LAKE NERKA (continued)</u>				
Hidden Lake Creek	8/16	200 2/		
Hidden Lake Beaches	6/16	530		
Anvil Bay Beaches	8/26	7,200		
Anvil Bay Beach to Elbow Pt. Beach	8/26	3,500		
Elbow Pt. Beach to Lynx Cr. Beach	8/26	2,200		
Lynx Creek to Teal Cr. Beaches	8/26	200		
Lynx Creek	8/19	2,080 2/		
Lynx Lake Beaches	8/26	4,600		
TOTAL		52,810	205,000	21.83
Little Togiak River	8/26	3,700	7,400	0.79
<u>LITTLE TOGIAK LAKE</u>				
Northshore Beaches	8/26	1,460		
Southshore Beaches	8/26	970		
D Slough Beach	8/26	3,000		
TOTAL		5,430	21,000	2.24
Agulukpak River	8/26	300,000	447,800	47.69
<u>LAKE BEVERLEY</u>				
Hardluck Bay Beaches	8/26	3,500		
Sam's Beach	8/26	500		
Golden Horn Beaches	8/26	500		
Silver Horn Beaches	8/26	1,200		
B12 Beach and B9 Beaches	8/26	1,050		
Tsun Creek	8/16	200		
Moose Creek	8/16	1,000		
Hope Creek	8/16	1,700		
Hope Creek Lake Beach	8/16	100		
TOTAL		8,750	34,000	3.62
Peace River	8/16	700	1,400	0.15

-Continued-

Table 1. Peak aerial live counts and total population estimates of sockeye salmon on the spawning grounds, Wood River Lakes, 1985 (continued).

Area	Aerial Counts		Total Population Estimate	
	Date	Number	Number	Percent
<u>LAKE MIKCHALK</u>				
Narrows	8/26	100		
Northshore Beaches	8/26	150		
Southshore Beaches	8/26	600		
TOTAL		850	3,000	0.32
Wind River	8/16	400	800	0.08
<u>LAKE KULIK</u>				
K5 Creek to K10 Beaches	8/26	710		
K10 Creek to K3 Creek Beaches	8/26	2,800		
K3 Creek to K2 Creek Beaches	8/26	0		
Southshore Beaches	8/26	1,130		
K1 and K2 Creeks	8/16	1,500		
TOTAL		6,140	24,000	2.55
Grant River	8/16	5,500	11,000	1.17
TOTAL ALL AREAS		465,450	939,000	100.00

1/ All counts rounded to nearest 10 fish.

2/ Ground survey counts by F.R.I. personnel (only live spawning fish were included).

Table 2. Summary of total population escapement estimates of sockeye salmon, Wood River Lakes system, 1946-1985.

Area	1985	40-Year Summary (1946-85)	
		Range	Mean
Wood River	7,800	800 - 75,000	15,500 1/
Lake Aleknagik	101,000	15,700 - 300,000	79,900
Agulowak River	74,800	5,000 - 1,000,000	145,200
Lake Nerka 2/	212,400	50,000 - 2,000,000	364,000
Little Togiak Lake	21,000	800 - 80,000	25,200
Agulukpak River	447,800	3,000 - 450,000	115,600
Lake Beverley	34,000	5,000 - 1,000,000	191,900
Peace River	1,400	100 - 23,000	7,400
Lake Mikchalk	3,000	600 - 88,000	16,400
Wind River	800	+ - 7,600	2,000
Lake Kulik 3/	35,000	3,500 - 375,800	97,200
TOTAL	939,000		1,060,300

1/ 1958-85 mean.

2/ Includes Little Togiak River total population estimate.

3/ Includes Grant River total population estimate.

Table 3. Percentage distributions of spawning sockeye salmon in three major types of spawning areas, and estimated total escapement, Wood River system, 1959-1985.

Year	Creeks	Beaches	Rivers	Total Escapement 1/
1959	32.8	50.3	16.9	2,209,300
60	27.4	55.5	17.1	1,016,100
61	11.4	32.3	56.3	460,700
62	24.0	65.2	10.8	873,900
63	12.1	68.5	19.4	721,400
1964	18.9	64.0	17.1	1,076,100
65	40.6	11.1	48.3	675,100
66	16.4	54.9	28.7	1,208,700
67	9.3	66.2	24.5	515,800
68	9.9	50.8	39.3	649,300
1969	8.6	42.4	49.0	604,300
70	14.0	52.4	33.6	1,162,000
71	11.2	56.8	32.0	851,200
72	17.4	45.1	37.5	430,600
73	11.5	23.9	64.6	330,500
1974	14.1	63.9	22.0	1,708,800
75	14.5	34.4	51.1	1,270,100
76	12.7	33.5	53.8	817,000
77	11.3	39.5	49.2	561,800
78	14.2	51.3	34.5	2,267,200
1979	7.3	60.4	32.3	1,706,400
80	20.8	24.5	54.7	2,969,000
81	23.0	20.7	56.3	1,233,000
82	14.0	17.2	68.8	976,400
83	14.3	60.9	24.8	1,361,000
1984	11.4	27.6	61.0	1,002,800
85	18.6	22.2	59.1	939,000
TOTAL	441.7	1,195.5	1,062.7	28,594,700
Mean	16.4	44.3	39.3	1,059,060

1/ Estimated from Wood River tower counts.

Spawning in the inter-connecting rivers (59% of the total) was comparable to the 1973, 1982, and 1984 escapements, three years with the highest percentages of fish ever observed in the rivers.

Nushagak-Mulchatna River System:

Escapement surveys of the main Nushagak and Mulchatna Rivers were precluded this season because waters in these two rivers were high and turbid, limiting observations to their smaller clear-water tributaries (index streams). Live counts and total population estimates of sockeye salmon for streams in the Nushagak-Mulchatna drainage that could be surveyed are shown in Table 4. The escapement estimate of 69,300 to this system was only half the recent 10-year average of 141,000. Spawning in the major clear-water streams, particularly King Salmon and Koktuli Rivers, was well below average and escapement to Okstukuk Lakes was poor again this year as it has been for the last three years. Table 5 provides a comparison of peak aerial live counts for selected index streams and portions of the main Nushagak and Mulchatna Rivers.

To obtain a total sockeye salmon escapement estimate for the Nushagak-Mulchatna Rivers, it was necessary to combine the aerial estimate with the Nuyakuk tower count, since the aerial surveys cover only those lakes and tributaries below, or adjacent to, the Tikchik Lake-Nuyakuk River complex, while those fish spawning in the Tikchik Lakes drainage were enumerated as they migrated past counting towers on the Nuyakuk River (Figure 7). It should be noted that hydroacoustic counting of all salmon species migrating up the Nushagak-Mulchatna River system is also conducted annually at Portage Creek, approximately 32 km (20 miles) upriver from the Nushagak River mouth. This relatively new program is still in the developmental stages, and has not yet consistently produced accurate total escapement estimates by species. For this reason, the Nuyakuk tower count, combined with the aerial escapement counts, was used as the total sockeye salmon escapement estimate to the system. When aerial escapement estimates for the Nushagak-Mulchatna Rivers were combined with the Nuyakuk tower count this season, the total sockeye salmon escapement was estimated to be 498,300 which was 177,000 more than what was enumerated by sonar (321,000) at Portage Creek.

In past years aerial surveys have always accounted for significantly more fish than what the sonar counter tallied. This year was no exception, even though improvements were made to the sonar counting techniques which allowed a more accurate escapement estimate. Sonar enumeration techniques are still being refined and it is anticipated that the difference between the two estimates will not be appreciable in future years.

Lake Nunavaugaluk:

Peak aerial live counts of sockeye salmon in 1985 for Lake Nunavaugaluk are presented in Table 6 along with the total spawning population estimate. Because the Snake River weir is no longer being operated by Division of Fisheries Rehabilitation, Enhancement, and Development, the aerial estimate of 34,880 is the only available estimate. This was a relatively good escapement for this system and is quite comparable to the 1984 escapement of 33,800. Distribution of the fish on the spawning grounds was similar to previous years (Figure 4).

Table 4. Peak aerial live counts and total population estimates of sockeye salmon on the spawning grounds in the Nushagak-Mulchatna drainage, 1985.

Stream	Aerial Counts		Total Population Estimate 2/
	Date	Number 1/	
Nushagak River 3/			
Portage Creek to Ekwok		-	
Ekwok to Mulchatna R.		-	
Mulchatna R. to Nuyakuk R.		-	
Nuyakuk R. to Klutispaw R.	7/31	4,300	
Klutis. R. to King Salmon R.	7/31	2,600	
King Salmon R. to Chichitnok R.	7/31	300	
Chichitnok R. to Big Bend	7/31	400	
Big Bend on North	7/31	1,300	
Nushagak River Total		8,900	
Muklung River	7/30	2,400	
Iowithla River	7/30	600	
Kokwok River	7/30	1,900	
Klutuk Creek		-	
Klutispaw River	7/30	0	
King Salmon River	7/30	8,600	
Chichitnok River	7/31	0	
NUSHAGAK DRAINAGE TOTAL		22,400	56,000
Mulchatna River 3/			
Stuyahok River	7/31	600	
Koktuli River	7/31	4,700	
Mosquito River		-	
Chilchitna River		-	
Chilikadrotna River		-	
MULCHATNA DRAINAGE TOTAL 3/		5,300	13,300
NUSHAGAK/MULCHATNA TOTAL		27,700	69,300

1/ Rounded to nearest 100 fish.

2/ Derived by expanding peak aerial live counts by a factor of 2.5 to reflect fish not counted due to variables such as schooled and dead fish, poor survey conditions, etc.

3/ Incomplete survey.

Table 5. Comparison of peak aerial live counts of sockeye salmon on the spawning grounds in selected index streams and portions of the main Nushagak and Mulchatna Rivers, by river system, 1977-1985^{1/}.

Year	Muklung	Iowithla	Klutispaw	King Salmon	Stuyahok	Koktuli	Nushagak River 2/	Mulchatna River 3/	Total
1977*	11,900	4,700	500	14,100	800	19,700	68,700	(16,700)	(137,100)
78*	1,700	100	0	5,800	300	4,700	11,400	7,400	31,400
79*	6,300	400	0	4,800	600	8,400	16,000	9,200	45,700
80	5,000	(1,100)	100	16,100	5,200	14,300	14,600	(7,800)	(64,200)
81	2,100	700	100	11,500	800	9,900	6,300	(4,400)	(35,800)
1982	3,300	300	0	1,100	1,000	4,700	400	(1,500)	(12,300)
83*	2,300	200	0	6,300	2,100	8,100	6,900	2,200	28,100
84	2,500	2,300	100	12,900	3,000	12,300	32,100	2,300	67,500
85	2,400	600	0	8,600	600	4,700	6,900	(3,300)	(27,100)
TOTAL	37,500	10,400	800	81,200	14,400	86,800	163,300	54,800	449,200
MEAN	4,200	1,200	100	9,000	1,600	9,600	18,100	6,100	49,900
Percent of Total 4/	7.4	1.7	0.1	17.3	3.5	19.4	38.4	12.2	100.0

1/ Numbers in parentheses are proportional estimates based on the mean percentage of fish counted in those areas when aerial coverage was complete (four years noted with an asterisk).

2/ Includes that section of Nushagak River between Nuyakuk River and King Salmon River.

3/ Includes that section of Mulchatna River between Koktuli River and Mosquito Creek.

4/ Includes only those years noted with an asterisk.

Table 6. Peak aerial live counts and total population estimates of sockeye salmon in the Lake Nunavaugluk, Togiak, and Kulukak drainages, 1985^{1/}.

Stream	Aerial Counts		Total Population Estimate	
	Date	Number	Factor 2/ Number	
LAKE NUNAVAUGLUK				
Snake River	8/26	100		
Snake R. to Eagle Cr. Beaches	8/26	4,070		
Eagle Creek	8/ 6	0		
Eagle Creek Lake Beaches	8/ 6	700		
Westshore Beaches	8/26	5,040		
Killian Creek	8/ 6	3,600		
Eastshore Beaches	8/26	2,240		
East Creek	8/ 6	1,200		
Southshore Beaches	8/26	490		
LAKE NUNAVAUGLUK TOTALS		17,440	2.0	34,880
TOGIAC SECTION				
Togiak River	8/16	1,800	2.0	3,600
Gechiak Lake System	8/16	400	2.0	800
Pungokepuk Lake System	8/16	500	2.0	1,000
Ongivinuck Lake	8/16	1,700	2.0	3,400
Kashaiak River	8/ 5	0	-	0
Narogurum River	8/ 5	0	-	0
Tributaries Sub-Total		4,400	2.0	8,800
Ungalik./Kukayachagak System	7/29	1,570	2.0	3,140
Matogak River	7/29	0	2.0	0
Osviak River	7/29	200	2.0	400
Slug River	7/29	2,300	2.0	4,600
Miscellaneous Sub-Total		4,070	2.0	8,140
KULUKAK SECTION				
Kulukak River	8/ 1	5,000	2.0	10,000
Kulukak Lake	8/15	1,700	2.0	3,400
Tithe Creek Ponds	8/16	11,600	2.0	23,200
Kulukak Sub-Total		18,300		36,600
TOGIAC DISTRICT TOTAL		26,770		53,540

1/ All counts rounded to nearest 10 fish.

2/ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

Peak aerial live counts and total spawning population estimates of sockeye salmon in the Togiak River tributaries and the Kulukak River system are given in Table 6. The total spawning population estimate for the Togiak River and its tributaries totaled 8,800, which is less than half the most recent 20-year average escapement of 19,300 fish. The spawning population estimated in the Kulukak system was 36,600, nearly equal to the 1976-1985 average and 54% higher than the most recent 20-yr average escapement. Table 7 provides a comparison of the total population estimate of sockeye salmon on the Togiak District spawning grounds for the years 1964-1985. Spawning distribution in 1985 was typical to that reported in previous years (Figures 5 and 6).

Nushagak District:

Aerial surveys to enumerate chinook salmon were flown in Nushagak District for the 18th consecutive year to obtain relative escapement indices in key index streams important to spawning chinook salmon, and to estimate the total chinook salmon escapement to the district. Counts were made on all of the important index streams, and portions of the main stem of the Nushagak River. However, surveys on the Mulchatna River were impossible due to high turbid water.

Because aerial survey data is often incomplete for the Nushagak and Mulchatna Rivers due to poor survey conditions, a method that would add the missing components and generate a total escapement estimate was developed using correlations for those years in which total counts were available (Bucher 1983). The method was used this season to estimate the total chinook salmon escapement using only index counts. The calculation was as follows:

Where Y = total population estimate of chinook salmon in the Nushagak and Mulchatna Rivers, including tributaries

Table 8 compares the eight years of comprehensive data used to develop the correlation between total peak aerial counts and total population estimates.

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Table 7. Comparison of total population estimates of sockeye salmon on the spawning grounds of the Togiak District, 1966-1985.

Year	Togiak River and Tributaries 1/	Kulukak Systems
1966	13,100	18,800
67	12,000	10,000
68	7,000	6,500
69	7,400	8,400
70	10,800	10,000
1971	9,400	13,000
72	4,500	3,400
73	11,200	8,000
74	20,600	4,900
75	19,600	8,600
1976	31,200	11,200
77	15,600	40,100
78	30,600	33,900
79	23,700	26,600
80	50,700	45,700
1981	39,700	58,800
82	25,300	52,800
83	13,200	27,000
84	30,900	49,800
85	8,800	36,600
20-Year Total	385,300	474,100
1966-75 Total	115,600	91,600
1976-85 Total	269,700	382,500
20-Year Average	19,270	23,710
1966-75 Average	11,560	9,160
1976-85 Average	26,970	38,250

1/ Estimates for Togiak River proper are unavailable and not included prior to 1974; estimates for Ungalikthluk, Osviak/ Matogak, and Slug River are not included in the 1977-85 data as reported earlier in Data Reports 73 and 81.

Table 8. Comparison of index counts and total peak aerial counts of chinook salmon for the main Nushagak and Mulchatna Rivers, 1968-1984^{1/}.

Year	Nushagak River			Mulchatna River			Total Index Counts	Total Escapement Estimate
	Index Count	Total Count	%	Index Count	Total Count	%		
1968	970	2,600	37.31	510	2,690	18.96	11,080	70,000
1974	2,340	6,270	37.32	2,160	6,530	33.08	15,030	70,000
1976	1,760	7,740	22.74	2,580	6,620	38.97	21,440	100,000
1977	820	5,300	11.35	1,980 2/	3,490	56.73	13,980	65,000
1978	5,850	15,490	37.77	2,280	8,240	27.67	28,520	130,000
1979	2,880	9,750	29.54	1,730	3,740 2/	46.26	19,930	95,000
1983	6,330	16,700	37.90	4,260	8,710	48.91	33,900	162,000
1984	2,800	9,040	30.92	1,060	3,670	28.88	13,660	72,000

1/ Only those years with comprehensive data are included.

2/ Surveys nearly complete but not a total count.

Table 9. Comparison of peak aerial live counts of chinook salmon on the spawning grounds in selected index streams and portions of the main Nushagak and Mulchatna Rivers, by river system, 1965-1985^{1/}.

Year	Muklung	Iowithla	Klutispaw	King Salmon	Stuyahok	Koktuli	Nushagak River 2/	Mulchatna River 3/	Total
1965	570	-	140	850	-	-	-	-	1,560
67	350	200	-	-	2,500	3,300	-	-	6,350
68*	750	850	310	1,000	2,470	4,220	970	510	11,080
69	520	580	90	670	1,220	1,600	(910)	(680)	(6,270)
70	590	700	320	1,060	1,900	1,500	(1,180)	(880)	(8,130)
1971	280	390	-	-	-	-	-	-	670
72	150	170	280	900	610	1,450	(690)	(510)	(4,760)
73	-	-	380	1,470	1,220	950	-	-	4,020
74*	1,010	860	440	2,000	2,300	3,920	2,340	2,160	15,030
75	660	1,040	670	2,900	2,530	4,080	(2,320)	(1,710)	(15,910)
1976*	840	1,110	1,180	3,510	3,750	6,710	1,760	2,580	21,440
77*	940	840	650	1,420	2,700	4,630	820	1,980	13,980
78*	1,170	1,700	1,940	4,450	4,400	6,730	5,850	2,280	28,520
79*	950	1,350	1,040	2,150	3,570	6,260	2,880	1,730	19,930
80	1,600	(2,310)	970	4,500	7,200	10,620	(5,300)	(3,920)	(36,420)
1981	2,260	2,630	1,650	2,950	5,980	9,960	(4,960)	(3,670)	(34,060)
82	790	2,520	350	8,390	3,640	6,780	(4,380)	(3,240)	(30,090)
83*	1,830	2,430	2,090	5,990	2,910	8,060	6,330	4,260	33,900
84*	1,300	1,080	770	1,780	2,010	2,860	2,800	1,060	13,660
85	1,250	1,610	1,950	4,460	2,690	4,940	(3,420)	(2,390)	(22,712)
TOTAL	17,810	22,370	15,220	50,450	53,600	88,570	46,910	33,560	
MEAN	940	1,240	850	2,800	2,980	4,920	2,930	2,100	
Percent of Total 4/	5.58	6.49	5.34	14.16	15.30	27.54	15.08	10.51	100.00

- 1/ Numbers in parentheses are proportional estimates based on the mean percentage of fish counted in those areas when aerial coverage was complete (eight years noted with an asterisk).
 2/ Includes that section of Nushagak River between Nuyakuk River and King Salmon River.
 3/ Includes that section of Mulchatna River between Koktuli River and Mosquito Creek.
 4/ Includes only those years noted with an asterisk.

Table 10. Peak aerial live counts and total population estimates of chinook salmon on the spawning grounds in the Nushagak District, 1985.

Stream	Aerial Counts		Tower Counts	Total Population Estimate 2/
	Date	Number 1/		
Nushagak River				
Portage Creek to Ekwok		-		
Ekwok to Mulchatna R.		-		
Mulchatna R. to Nuyakuk R.		-		
Nuyakuk R. to Klutispaw R.	7/31	420		1,260
Klutis. R to King Salmon R.	7/31	760		2,280
King Salmon R. to Chichitnok R.	7/31	240		720
Chichitnok R. to Big Bend	7/31	1,520		4,560
Big Bend on North	7/31	2,740		8,220
Nushagak River Total		5,680		17,040
Iowithla River	7/30	1,610		4,830
Kokwok River	7/30	60		180
Klutuk Creek		-		-
Klutispaw River	7/30	1,950		5,850
King Salmon River	7/30	4,460		13,380
Chichitnok River	7/31	1,140		
NUSHAGAK DRAINAGE TOTAL		14,900		44,700
Mulchatna River		4/		
Stuyahok River	7/31	2,690		8,070
Koktuli River	7/31	4,940		14,820
Mosquito River		-		-
Chilchitna River		-		-
Chilikadrotna River		-		-
MULCHATNA DRAINAGE TOTAL 4/		7,630		22,890
Nuyakuk River	-	-	2,616	2,616
Wood River	8/ 6	20	114	174
Muklung River	7/30	1,250	-	3,750
Igushik River	8/ 1	200	132	732
Snake River	8/ 1	10	-	30
DISTRICT TOTAL		24,010	2,862	115,720 3/

1/ Rounded to nearest 10 fish.

2/ Derived by expanding peak aerial live counts by a factor of three to reflect fish not counted due to variables such as schooled and dead fish, poor survey conditions, etc.

3/ Derived from a correlation between index counts and total escapement estimates based on eight years of comprehensive data in which aerial surveys were complete. Surveys were incomplete this season because of high turbid water.

4/ Incomplete survey.

Table 11. Summary of inshore commercial catch and escapement of chinook salmon, Nushagak and Togiak Districts, in thousands of fish, 1966-1985^{1/}.

Year	Nushagak District			Togiak District		
	Catch	Escapement 2/	Total Run	Catch	Escapement 3/	Total Run
1966	58	40 a/	98	10	-	-
67	96	65 b/	161	13	10	23
68	78	70	148	13	16	29
69	81	35	116	20	8	28
70	88	50	138	29	15	44
1971	83	40 4/	123	27	20	47
72	46	25	71	20	14	34
73	30	35	65	11	11	22
74	32	70	102	11	15	26
75	21	70	91	7	11	18
1976	61	100	161	30	14	44
77	85	65	150	35	20	55
78	119	130	249	57	40	97
79	157	95	252	30	20	50
80	65	141	206	13	12	25
1981	193	150	343	24	27	51
82	195	147	342	34	17	51
83	139 5/	162	301	38 5/	22	60
84	61 5/	81	142	22 5/	26	48
85	68 5/	116	184	37 5/	14	51
20-Year Total	1,756	1,687	3,443	481	332	803
1966-75 Total	613	500	1,113	161	120	271
1976-85 Total	1,143	1,187	2,330	320	212	532
20-Year Average	88	84	172	24	17	40
1966-75 Average	61	50	111	16	13	30
1976-85 Average	114	119	233	32	21	53

- 1/ Escapement estimates are based on data collected on comprehensive aerial surveys of the spawning grounds; these escapement estimates supersede previously reported escapements.
- 2/ Comprehensive aerial coverage was begun in 1968; escapements prior to 1968 were derived from:
 - a/ tower enumeration data from Nushagak River, and estimate of total escapement accounted for by tower enumeration.
 - b/ tower enumeration data, minimal aerial survey coverage, and general run strength indicators (commercial and subsistence catches).
- 3/ Comprehensive aerial survey coverage was begun in 1967.
- 4/ Aerial escapement estimate precluded by adverse weather; escapement was estimated from mean exploitation rates from 1966-70 and 1972-76.
- 5/ Preliminary.

Togiak-Kulukak River Systems:

Table 12 shows the peak aerial live counts and total spawning population estimates of chinook salmon by individual streams in the Togiak District. The 1985 Togiak District chinook salmon escapement of 14,300 was the lowest in the last 5 years and 3,000 fish lower than the 1966-1985 average. The low escapement may be partially attributed to the commercial harvest of 37,000 chinook salmon in this district, which was the second largest catch since 1978. Table 10 summarizes the commercial catch and escapement of chinook salmon in both Nushagak and Togiak Districts for the years 1966-1985.

Chum Salmon

Nushagak District:

Chum salmon surveys are no longer flown in the Nushagak District but are only conducted in the Togiak District, where duration of spawning is shorter and visibility is better in the clear-water streams. The 1985 Nushagak drainage chum salmon escapement was estimated using data from the Portage Creek sonar counter. The final estimate was 288,000 which was 20,000 fish more than the 1966-1985 average escapement estimate of 268,000, but 23% less than the most recent 10-year average. Table 13 provides a summary of the commercial catch and escapement of chum salmon in the Nushagak and Togiak Districts for the years 1966-1985.

Togiak District:

Comprehensive chum salmon surveys were continued in the Togiak District for the 19th consecutive year. Table 14 shows the peak aerial live counts and total population estimates of chum salmon by river system for the Togiak District. Escapements totaled 212,000 for the entire district which is 9% lower than the 1966-1985 average and 31% lower than the most recent 10-year average. Table 13 compares the 1985 escapement with the previous 20 years.

Pink Salmon

Aerial surveys of pink salmon are not conducted in odd years because pink salmon runs in Bristol Bay exhibit cyclic abundance and are almost non-existent in these districts during odd years.

Coho Salmon

Aerial surveys of coho salmon escapements were again conducted in the Togiak District in response to the growing commercial fishing effort and increased interest in the coho salmon fishery. Prior to the spawning ground surveys, inseason "management" surveys were conducted to determine escapement rates as well as relative abundance in the Togiak and Kulukak Rivers. Although these surveys were not used to estimate the total spawning population, they provided additional information regarding migration timing, distribution, holding and schooling behavior, etc. Nearly all coho salmon surveys were hampered by high turbid water conditions and heavy precipitation.

Table 15 shows aerial live counts and total population estimates of coho salmon on the spawning grounds in the Togiak District. The main stem of the

Table 12. Peak aerial live counts of chinook salmon on the spawning grounds, Togiak District, 1985^{1/}.

Stream	Aerial Counts		Total Population Estimate	
	Date	Number	Factor 2/	Number
<u>Togiak River</u>				
Togiak Bay to Gechiak Cr.	8/ 5	270	2.5	680
Gechiak Cr. to Pungokepuk Cr.	8/ 5	320	2.5	800
Pungokepuk Cr. to Kashaiaik R.	8/ 5	640	2.5	1,600
Kashaiaik R. to Narogurum R.	8/ 5	340	2.5	850
Narogurum R. to Ongivinuck R.	8/ 5	470	2.5	1,180
Ongivinuck R. to Togiak Lk.	8/ 5	970	2.5	2,430
Togiak River Total		3,010		7,540
Gechiak Creek	8/ 5	470	2.5	1,180
Pungokepuk Creek	8/ 5	250	2.5	630
Kashaiaik River	8/ 5	290	2.5	730
Narogurum River	8/ 5	310	2.5	780
Ongivinuck River	8/ 5	460	2.5	1,150
TOGIAK RIVER DRAINAGE TOTAL		4,790		12,010
Ungalikthluk River	7/29	80	4.0	320
Kukayachagak River	7/29	90	2.5	230
Kulukak River	8/ 1	540	2.5	1,350
Osviak River	7/29	50	2.5	130
Matogak River	7/29	100	2.5	250
Quigmy River	7/29	0		0
DISTRICT TOTAL		5,650		14,290

1/ All counts rounded to nearest 10 fish.

2/ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

Table 13. Summary of commercial catch and escapement of chum salmon, Nushagak and Togiak Districts, in thousands of fish, 1966-1985^{1/}.

Year	Nushagak District			Togiak District		
	Catch	Escapement 2/	Total Run	Catch	Escapement 3/	Total Run
1966	129	80	209	95	-	-
67	338	200	538	63	179	242
68	179	100	279	108	348	456
69	214	130	344	66	85	151
70	435	273	708	101	241	342
1971	360	226	586	124	229	353
72	310	195	505	179	170	349
73	336	200	536	195	163	358
74	158	100	258	81	161	242
75	153	80	233	87	114	201
1976	801	500	1,301	154	392	546
77	900	609	1,509	271	496	767
78	652	293	945	275	396	671
79	440	166	606	220	293	513
80	682	969	1,651	300	415	715
1981	795	177	972	230	331	561
82	435	256	691	151	86	237
83	586 4/	164	750	323 4/	165	488
84	680 4/	362	1,037	339 4/	204	543
85	253 4/	288	541	206 4/	212	418
20-Year Total	8,836	5,368	14,199	3,568	4,680	8,153
1966-75 Total	2,612	1,584	4,196	1,099	1,690	2,694
1976-85 Total	6,224	3,784	10,003	2,469	2,990	5,459
20-Year Average	441	268	709	178	234	429
1966-75 Average	261	158	420	110	188	299
1976-85 Average	622	378	1,000	251	308	545

- 1/ Escapement estimates are based on data collected on comprehensive aerial surveys of the spawning grounds; these estimates supercede previously reported escapements, and are rounded to the nearest thousand fish.
- 2/ Escapement estimates were derived from the following:
- (a) 1966 - tower enumeration data from Nushagak River.
 - (b) 1967 - tower enumeration data, and proportion of escapement to catch in 1966 and 1968.
 - (c) 1968 and 1973-74 - tower enumeration and aerial survey data.
 - (d) 1970-72 - average catch/escapement ratio for 1968-69 and 1973-81.
 - (e) 1975-76 - incomplete aerial survey data.
 - (f) 1977-78 - comprehensive aerial survey data.
 - (g) 1979-85 - adjusted sonar estimate from Portage Creek site.
- 3/ Comprehensive aerial survey coverage was begun in 1967.
- 4/ Preliminary.

Table 14. Peak aerial live counts and total population estimates of chum salmon on the spawning grounds, Togiak District, 1985^{1/}.

Stream	Aerial Counts		Total Population Estimate 1/	
	Date	Number	Expansion Factor	Number
<u>Togiak River</u>				
Togiak Bay to Gechiak Cr.	8/ 5	8,300	2.5	20,750
Gechiak Cr. to Pungokepuk Cr.	8/ 5	6,500	2.5	16,250
Pungokepuk Cr. to Kashaiak R.	8/ 5	3,200	2.0	6,400
Kashaiak R. to Narogurum R.	8/ 5	900	2.0	1,800
Narogurum R. to Ongivinuck R.	8/ 5	6,700	2.0	13,400
Ongivinuck R. to Togiak Lk.	8/ 5	10,200	2.0	20,400
Togiak River Total		35,800		79,000
Gechiak Creek	8/ 5	4,100	2.0	8,200
Pungokepuk Creek	8/ 5	600	2.0	1,200
Kashaiak River	8/ 5	9,600	2.0	19,200
Narogurum River	8/ 5	1,800	2.0	3,600
Ongivinuck River	8/ 5	8,300	2.0	16,600
TOGIK RIVER DRAINAGE TOTAL		60,200		127,800
Ungalikthluk River	7/29	130	3.0	390
Kukayachagak River	7/29	14,650	2.0	29,300
Kulukak River	8/ 1	7,800	2.0	15,600
Slug River	7/29	8,800	2.0	17,600
Osviak River	7/29	5,460	2.0	10,920
Matogak River	7/29	2,860	2.5	7,150
Quigmy River	8/ 1	1,800	2.0	3,600
DISTRICT TOTAL		101,700		212,360

1/ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

Table 15. Peak aerial live counts and total population estimates of coho salmon on the spawning grounds, Togiak District, 1985^{1/}.

Stream	Aerial Counts		Total Population Estimate 2/	
	Date	Number	Expansion Factor	Number
<u>Togiak River</u>				
Togiak Bay to Gechiak Cr.	3/	800		2,400
Gechiak Cr. to Pungokepuk Cr.	3/	660		1,980
Pungokepuk Cr. to Kashaiaik R.	3/	110		330
Kashaiaik R. to Narogurum R.	3/	70		210
Narogurum R. to Ongivinuck R.	10/3	150		450
Ongivinuck R. to Togiak Lk.	10/3	820		2,460
Togiak River Total		2,610	3.0	7,830
Gechiak Creek	10/3	1,340	3.0	4,020
Pungokepuk Creek	10/3	750	3.0	2,250
Kashaiaik River	10/3	40	3.0	120
Narogurum River	10/3	80	3.0	240
Ongivinuck River	10/3	6,250	3.0	18,750
TOGIAK RIVER DRAINAGE TOTAL		11,070		33,210
Kulukak River	10/3	7,790	3.0	23,370
Osviak River	9/19	420	4.0	1,680
Matogak River	9/19	610	4.0	2,440
Quigmy River	9/19	200	3.0	600
DISTRICT TOTAL		20,090		61,300

1/ All counts rounded to the nearest 10 fish.

2/ Derived by expanding peak live count to reflect fish not counted due to variables such as schooled and dead fish, late or poor survey conditions, bad weather, etc.

3/ Due to turbid water conditions, this number is a proportional estimate based on 1984 data when surveys were complete.

Togiak River from Togiak Bay (river mouth) to the Narogurum River was not surveyed due to turbid water conditions. The escapement for this portion of the river was proportionally estimated using 1984 data when surveys were complete.

Although coho salmon escapements in most drainages throughout the district were significantly down from 1984 levels, spawning in the Ongivinuck River was comparable with last year's record level. This river, and its tributaries, with 18,750 fish, contained 56% of the spawners in the Togiak River drainage and represented nearly 30% of the entire district's escapement. The total district escapement of 61,300 was 28% below the 1980-1985 average (85,500) and comparable to the 1981 escapement.

LITERATURE CITED

- Bucher, W.A. 1983. Spawning ground surveys in the Nushagak and Togiak Districts of Bristol Bay, 1982. Alaska Department of Fish and Game, Bristol Bay Data Report No. 93. 29 pp.
- Evzerov, A.V. 1975. An evaluation of the errors occurring in salmon census by aerial survey. In Can. Transl. Fish. Aquat. Sci. No. 4714, 1981. [Transl. from Russian] (Otsenka pogreshnogtei aerovizual'nogo metoda ucheta Lososei, p. 82-84. From Lososevye Dal'Nego Vostoka (CVI):1975).
- Neilson, J.D. and G.H. Green. 1981. Enumeration of spawning salmon from spawner residence time and aerial counts. Transactions of the American Fisheries Society 110: 554-556.
- Nelson, M.L. 1979. Spawning ground surveys in the Nushagak and Togiak Districts of Bristol Bay, 1977-1979. Alaska Department of Fish and Game, Bristol Bay Data Report No. 73. 55 pp.
- Rogers, D.E. 1984. Aerial survey estimates of Bristol Bay sockeye salmon escapements, p. 197-208. In Proc. Wrkshp. on Stream Indexing for Salmon Escapement Estimation. Can. Tech. Rep. Fish. Aquat. Sci. No. 1326: 197-208.

1985 SPAWNING GROUND SURVEYS IN NAKNEK-KVICHAK DISTRICT

By

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INTRODUCTION

Aerial surveys were made during late summer and fall to assess escapements of sockeye, chinook, chum, and coho salmon in major spawning areas of the Naknek-Kvichak District. Estimates of sockeye salmon escapement were made on the Alagnak (Branch) River system, while estimates for chinook, chum, and coho salmon were made on the Alagnak and Naknek drainages. The Alagnak River system is composed of four major lakes drained by two rivers (Figure 1). Kukaklek and Battle Lakes are drained by the Alagnak River and Nonvianuk and Kulik Lakes are drained by the Nonvianuk River. These two rivers eventually merge into the mainstem Alagnak River which flows into the important Kvichak River just downstream from the village of Levelock. An aerial survey was also made for sockeye salmon escapement in Brooks River and Brooks Lake in order to estimate the number of fish that may possibly ascend Brooks Falls and the fish ladder located there. No surveys were flown on the Kvichak River during 1985.

Stock-specific management of the Alagnak River system is impossible because of the mixture of Alagnak fish with the usually more dominant Kvichak and Naknek River fish. The Alagnak is an important contributor to the Naknek-Kvichak District escapement in some years as evidenced by the comparison to both the Kvichak and Naknek Rivers in Table 1. Escapement estimates of sockeye salmon previously were made using counting towers from 1957-1976 but because of logistical problems and budget constraints, aerial surveys have replaced towers as the present enumeration method.

The Alagnak River is also an important producer of chinook, chum, pink, and coho salmon. Because surveys are not presently conducted to enumerate chum, pink, and coho salmon, only incidental observations are available. The counts that were made must, in all cases, be considered minimal since no attempt was made to expand the counts or schedule the surveys to coincide with peak abundance on the spawning grounds.

METHODS

Aerial survey methods during 1985 were similar to those used in past years and were conducted as close as possible to peak spawning times (Bill 1977). Estimates were made of live (spawning, migrating, and schooling) as well as dead fish for most known spawning areas.

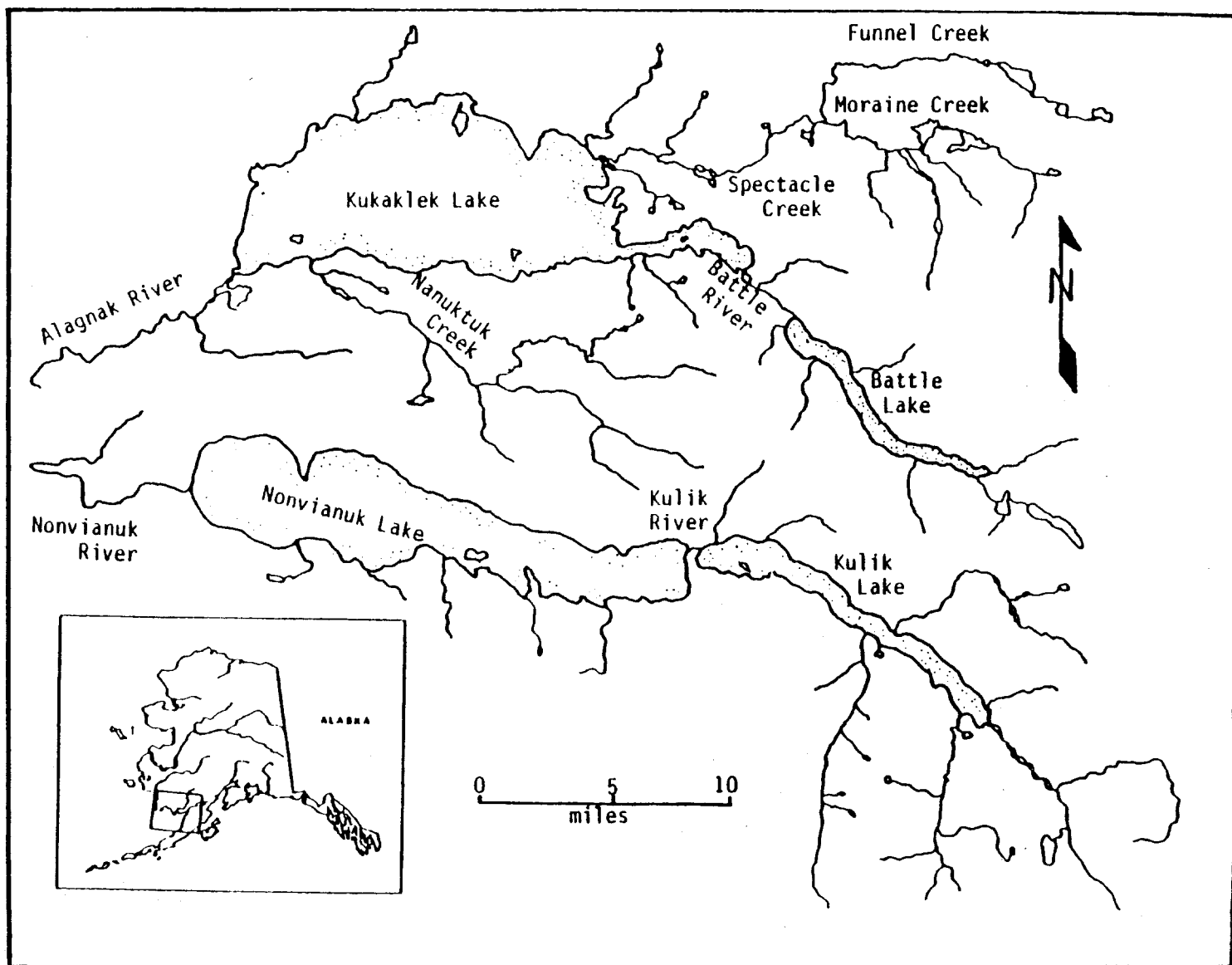


Figure 1. Alagnak River system.

Table 1. Aerial survey estimates of sockeye salmon spawning in the Alagnak River system, 1985.

Location	Number of Fish				Percent of System Total
	Spawning	Dead	Schooled	Total	
Nonvianuk River	100	30	200	330	0.28
Nonvianuk Lake					4.27
South Beach	200	80	640	920	
North Beach	2,100	370	1,650	4,120	
Kulik River	20,000	4,500	25,000	49,500	41.94
Kulik Lake					1.21
South Beach	0	0	0	0	
North Beach	1,000	130	300	1,430	
Alagnak River	0	0	0	0	0
Kukaklek Lake					1.02
South Beach	650	200	0	850	
North Beach	250	100	0	350	
Nanuktuk Creek	6,400	2,700	400	9,500	8.05
Battle River	19,000	6,800	3,800	29,600	25.08
Battle Lake					0.87
South Beach	150	150	550	850	
North Beach	150	30	0	180	
Spectacle Creek	10,900	3,300	300	14,500	
Funnel Creek	5,000	500	100	5,600	17.28
Moraine Creek	300	0	0	300	
Totals	66,200	18,890	32,940	118,030	100.00

Otoliths were collected from the Alagnak system sockeye salmon in order to assess age composition. The 6 August survey in the Naknek drainage was made in a Cessna 180 piloted by an experienced survey pilot. The 17 August and 27 August surveys were made in a Piper Super Cub with a different pilot, but still an experienced survey pilot. Surveys were conducted from altitudes of 300-500 feet from speeds of 80-110 mph. This was my eleventh year of flying escapement surveys as sole observer in the aircraft. Although aerial counts included all fish observed on the surveys, no attempt was made to expand the counts for fish not observed. It is recognized that an unknown percentage of the spawning escapement is not counted by this method but sufficient data does not exist for these systems which would allow the aerial counts to be adjusted to account for the unobserved proportion.

RESULTS

Sockeye Salmon

Aerial surveys were conducted on the Alagnak River for the ninth consecutive year to determine abundance and distribution of sockeye salmon by major spawning area which include: Nanuktuk Creek, Spectacle Creek, Kulik River, and Battle River (Figure 1). Normally creek spawning occurs about a week earlier than the river spawning.

Creek surveys were flown on 17 August and the remainder of the system was flown on 27 August. Both surveys were very close to the peak of spawning. Escapement estimates of sockeye salmon for the Alagnak River system are presented by area in Table 1. The total estimated spawning escapement for the system was 118,030 (Table 1). This escapement was less than the 1966-1985 average (Table 2) and less than the escapement goal of 185,000. The Alagnak system cannot be managed separately because of the mixture with the more dominant Naknek and Kvichak River stocks. However, it is an important producer in some years as evidenced by past escapements summarized in Table 2.

Age Composition:

Otoliths were collected from sockeye salmon on three of the four major spawning areas in the Alagnak system. Analysis of these data show that the age composition of the escapement was 69% age 5(2) and 24% age 4(2) (Table 3). Dominant age classes for individual spawning areas were as follows: Nanuktuk Creek - 38% 4(2), Kulik River - 87% 5(2), and Battle River - 54% 5(2).

Other Species

Surveys of the Alagnak River to enumerate chinook salmon were flown on 17 August. Incidental counts were also made on chum salmon during this survey. Weather and visibility were good and results indicated 9,518 chinook and 31,200 chum salmon were present (Table 4). The survey was past the peak of spawning for chinook salmon but close to peak spawning for chum salmon. No coho or pink salmon were observed.

Table 2. Escapement of sockeye salmon in the Naknek-Kvichak District by river system, 1966-1985.

Year	Escapement 1/			Total	Alagnak Contribution (% of Total)
	Kvichak	Naknek	Alagnak		
1966	3,775,184	1,016,445	174,336	4,965,965	3.5
67	3,216,208	755,640	202,626	4,174,474	4.9
68	2,557,440	1,023,222	193,872	3,774,534	5.1
69	8,394,204	1,331,202	182,490	9,907,896	1.8
70	13,935,306	732,502	177,060	14,844,868	1.2
1971	2,387,392	935,754	187,302	3,510,448	5.3
72	1,009,962	586,518	151,188	1,747,668	8.7
73	226,554	356,676	35,280	618,510	5.7
74	4,433,844	1,241,058	214,848	5,889,750	3.6
75	13,140,450	2,026,686	100,480	15,267,616	0.7
1976	1,965,282	1,320,750	81,822	3,367,854	2.4
77	1,341,144	1,085,856	100,000	2,527,000	4.0
78	4,149,288	813,378	229,400	5,192,066	4.4
79	11,218,434	925,362	294,200	12,437,996	2.4
80	22,505,268	2,644,698	297,900	25,447,866	1.2
1981	1,754,358	1,796,220	82,210	3,632,788	2.3
82	1,134,840	1,155,552	239,300	2,529,692	9.5
83	3,569,982	888,294	96,220	4,554,496	2.1
84	10,490,670	1,242,474	215,370	11,948,514	1.8
85	7,211,046	1,849,938	118,030	9,179,014	1.3
20-Yr. Mean	5,920,843	1,186,411	168,697	7,275,951	
1966-75 Mean	5,307,654	1,000,570	161,948	6,470,173	
1976-85 Mean	6,534,031	1,372,252	175,445	8,081,729	

1/ Escapement data from tower counts except for Alagnak River which is from aerial counts for the years 1977-1985.

Table 3. Age composition of sockeye salmon escapement in the Alagnak River system, 1985.

Age Class	Nanuktuk Creek		Spectacle Creek 1/		Kulik River		Battle River		Total System	
	No. of Samples	Percent	No. of Samples	Percent	No. of Samples	Percent	No. of Samples	Percent	Escapement Estimate	Weighted Mean Proportion(%)
3(2)	1	0.49	-	-	1	0.49	0	0.00	395	0.33
4(2)	79	38.35	-	-	26	12.62	79	37.09	27,792	23.55
4(3)	0	0.00	-	-	0	0.00	0	0.00	0	0.00
5(3)	60	29.13	-	-	0	0.00	18	8.45	7,040	5.96
5(2)	46	22.33	-	-	179	86.89	114	53.52	81,224	68.82
6(3)	20	9.71	-	-	0	0.00	2	0.94	1,579	1.34
Totals	206	100.00			206	100.00	213	100.00	118,030	100.00

1/ No samples taken.

Table 4. Summary of miscellaneous aerial live counts of salmon on the spawning grounds in the Naknek-Kvichak River drainages, by area and species, 1985.

River/Creek	Species			
	Kings	Chums	Pinks	Cohos
Main Branch River	6,048	31,200	0	0
Nonvianuk River	1,958	0	0	0
Upper Alagnak River	1,512	0	0	0
Total Alagnak Drainage	9,518	31,200	0	0
King Salmon Creek	500	0	0	0
Pauls Creek	170	0	0	0
Big Creek	2,900	3,000	0	0
Naknek River	700	0	0	0
Total Naknek Drainage	4,270	3,000	0	0
Kvichak River	(Not surveyed in 1985)			
Total All Areas	13,788	34,200	0	0

NOTE: These data in many cases represent only incidental observations, and in all cases must be considered minimal since no attempt was made to expand the counts or schedule the surveys to coincide with peak abundance on the spawning grounds.

The Naknek system was flown on 6 August and the main Naknek River on 27 August. Both of these surveys were flown to enumerate chinook salmon, although counts of chum salmon were obtained incidentally to the chinook salmon estimates. The 6 August survey was flown under partly cloudy, fairly bright conditions with about 10 knots of wind. Although King Salmon Creek was slightly murky and visibility was somewhat impaired, the number of spawning chinook salmon was estimated at 400-600 with a point estimate of 500. Timing of the survey was slightly earlier than the peak of spawning. Paul's Creek contained an estimated 150-250 spawners with a point estimate of 170. The survey of Big Creek produced a chinook salmon estimate of 2,900 and a range of 2,500-3,600 with the majority of spawners observed in the upper third of the creek, and mostly concentrated in the left fork (looking upstream). Redds in the lower creek contained two to four spawners each, while the upper section averaged three to five each. Incidental counts of chum salmon yielded an estimate of 3,000 spawners in the Big Creek drainage (Table 4).

The main Naknek River was flown on two occasions to estimate chinook salmon escapement. The 6 August survey was much too early with a point estimate of 600 and a range of 550-700. The second survey of 27 August was much closer to the peak of spawning and an estimate of 700 with a range of 650-850 was observed.

LITERATURE CITED

- Bill, Donald L. 1977. Alagnak (Branch) River system sockeye salmon spawning ground surveys, 1944-1976. Alaska Department of Fish and Game, Division of Commercial Fisheries, Data Report No. 57. 45 pp.

1985 SPAWNING GROUND SURVEYS IN EGEGIK DISTRICT

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INTRODUCTION

The Egegik River system (Figure 1) contains two major river drainages: (1) the Egegik River proper, which drains Becharof Lake, and (2) the King Salmon River, draining runoff from the Kejulik Mountains and southern portions of Katmai National Park. These two rivers merge at the head of Egegik Bay near the village of Egegik.

The Egegik River drainage supports runs of all five species of salmon common to Alaskan waters. Large runs of sockeye salmon return annually with lesser runs of coho, chum, pink, and chinook salmon (generally in that order of relative abundance). Sockeye salmon are enumerated annually at counting towers on Egegik River approximately 1.5 miles downstream from Becharof Lake. Runs of the other species are not monitored with counting towers due to run timing and distribution differences. Aerial surveys are employed in some years to obtain abundance indices of these other species.

The King Salmon River drainage also supports all five species of Alaskan salmon. Chum salmon are the most abundant species in this drainage followed by coho, chinook, pink, and sockeye salmon, respectively. The river's mainstem is glacially turbid during the summer-fall period so visual enumeration methods are not practical for abundance estimation in lower river areas. Several headwaters tributaries (Gertrude Creek, Takayoto Creek, Contact Creek, etc.) are clear throughout the late summer-fall period and can be aerially surveyed to provide spawning abundance indices.

Aerial surveys were flown in both the Egegik and King Salmon River drainages during 1985 to estimate spawning abundance indices for chinook and chum salmon. Coho salmon abundance observations were also made on two surveys of the mainstem Egegik River.

METHODS

Aerial surveys utilizing the services of local air charter companies were flown in a Piper Super Cub piloted by an experienced survey pilot. Chinook and chum salmon surveys were flown on 6 August in major spawning areas of the Egegik and King Salmon Rivers. Follow-up observations were made on 26 August in the Egegik River. Coho salmon surveys were flown on 26 August and 12

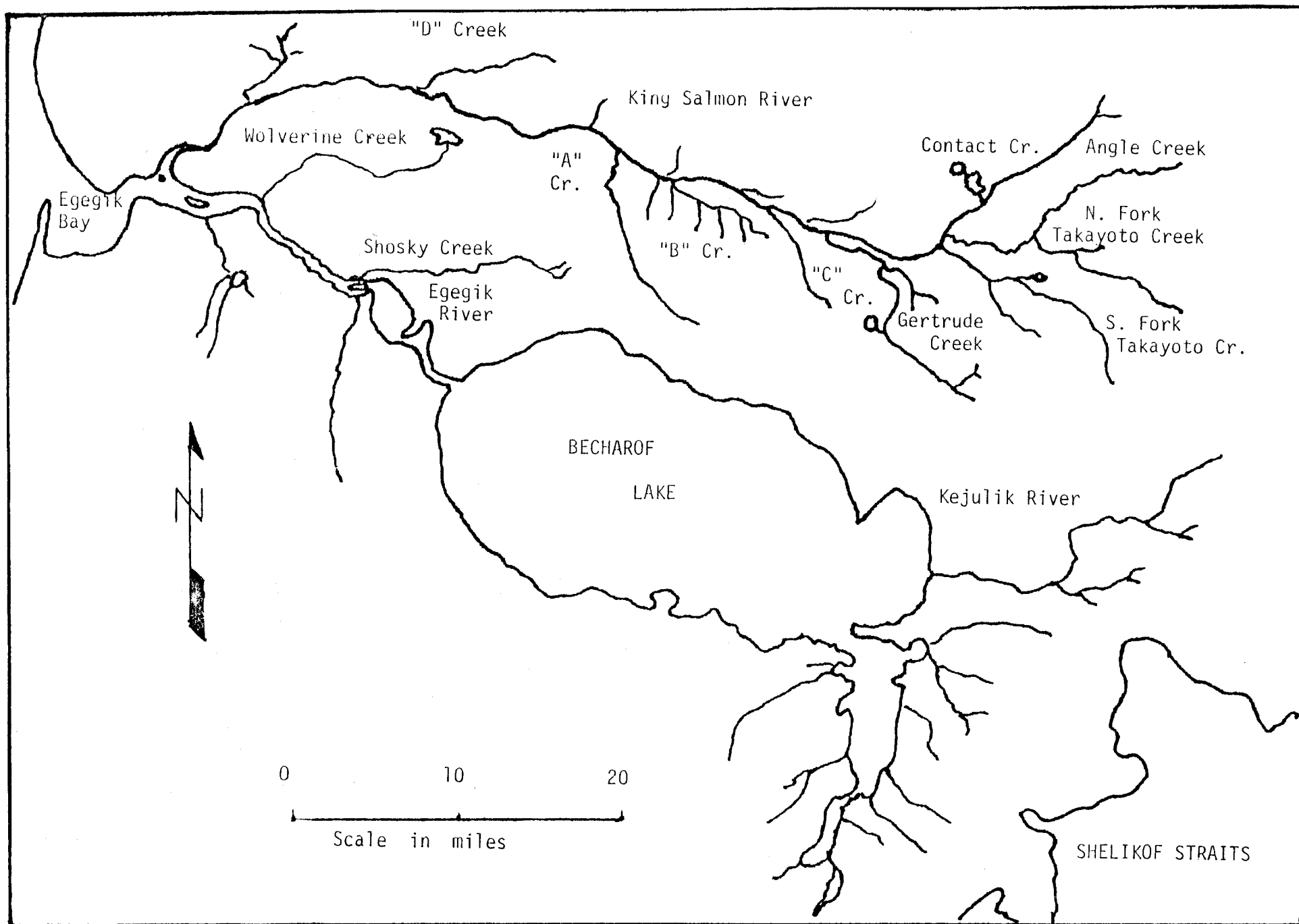


Figure 1. Egegik River drainage.

September only in the Egegik River drainage. All surveys were conducted at an altitude of 200-400 ft, and the counts were not expanded.

RESULTS

Sockeye Salmon

No sockeye salmon surveys were flown in the Egegik River drainage because the Egegik River tower count of 1,095,204 sockeye salmon was sufficient to document run strength in the drainage. An estimated 100 sockeye salmon were noted spawning in a small lake tributary to Contact Creek in the King Salmon River drainage on 6 August. No other sockeye salmon were observed in the King Salmon River drainage.

Chinook Salmon

Chinook salmon surveys were flown for the fourth consecutive year in the Egegik system. Coverage was expanded this year to include five additional tributaries in the King Salmon River drainage as well as side channels of King Salmon River proper. A total of 1,080 chinook salmon were counted (Table 1). The 6 August survey was probably two days prior to the peak of spawning activity, but fish were well distributed in the spawning areas on redds and in groups in the larger pools. The main channels of the King Salmon River were very turbid but some side channels and shallow areas were clear enough to survey and no chinook salmon were observed.

Historic chinook salmon escapement counts for the drainage are presented in Table 2, which indicates a downward trend in abundance on Gertrude Creek and Contact Creek. Management actions are planned for the 1986 commercial season to aid in reversing this trend.

Chum Salmon

Chum salmon surveys were conducted incidentally to chinook salmon surveys in both the Egegik River and King Salmon River drainages. A total of 5,100 chum salmon were observed (Table 3). The survey on 6 August was about a week prior to the peak of chum salmon spawning in most areas, although it appeared to be close to peak at Contact Creek. Five tributaries, the side channels of the mainstem King Salmon River, were added to the survey program this season. Historic chum salmon survey counts are presented in Table 4. The historic data indicate chum salmon escapement numbers were down considerably from the preceding three years in the major spawning areas (Gertrude Creek, Takayoto Creek, and Contact Creek). This apparent drop in escapement may be attributed to the extremely high levels of fishing effort exerted on the Egegik District during the late June-early July sockeye salmon fishery. A total of 110,000 chum salmon were harvested during this fishery. Because peak abundance (highest mean daily catch) of chum salmon historically overlaps that of sockeye salmon (10 July vs 7 July, respectively) management to increase chum salmon escapement is quite difficult. Allowing escapement "windows" late in the sockeye salmon fishery may be a viable strategy for insuring adequate chum salmon escapements in the future.

Table 1. Peak aerial counts of chinook salmon on the spawning grounds, Egegik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
Egegik River	8/26	75
Shosky Creek	8/ 6	80
Gertrude Creek	8/ 6	260
Takayoto Cr. (N. Fork)	8/ 6	315
Takayoto Cr. (S. Fork)	8/ 6	230
Contact Creek	8/ 6	95
"A" Creek	8/ 6	0
"B" Creek	8/ 6	15
"C" Creek	8/ 6	10
"D" Creek	8/ 6	0
Mainstem King Salmon River	8/ 6	0
Egegik Drainage Total		1,080

1/ All counts unexpanded and rounded to nearest 5 fish.

Table 2. Chinook salmon escapement counts, Egegik River drainage, 1932-1985^{1/}.

Year	Egegik River	Shosky Cr.	Gertrude Cr.	Takayoto Cr.		Contact Cr.	"A" Cr.	"B" Cr.	"C" Cr.	"D" Cr.
				N. Fork	S. Fork					
1932	103	2/								
1952	16	2/								
1953	39	2/								
1954	49	2/								
1955	52	2/								
1956	20	2/								
1963	175					4				
1969	6									
1981	-		515							
1982	300		900			300				
1983	-		860	380		375				
1984	40	300	600	350		110				
1985	75	80	260	315	230	95	0	15	10	0
Mean	80	190	627	348	230	177	0	15	10	0

1/ Peak aerial counts unless otherwise noted. Data unexpanded.

2/ Weir counts.

Table 3. Peak aerial counts of chum salmon on the spawning grounds, Egegik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
Egegik River	8/26	300
Shosky Creek	8/ 6	0
Gertrude Creek	8/ 6	2,600
Takayoto Cr. (N. Fork)	8/ 6	0
Takayoto Cr. (S. Fork)	8/ 6	800
Contact Creek	8/ 6	500
"A" Creek	8/ 6	600
"B" Creek	8/ 6	200
"C" Creek	8/ 6	(+)
"D" Creek	8/ 6	0
Mainstem King Salmon River	8/ 6	100
Egegik Drainage Total		5,100

1/ All counts rounded to the nearest 100 fish and nonexpanded.

Table 4. Chum salmon escapement counts, Egegik River drainage, 1932-1985^{1/}.

Year	Egegik River	Shosky Cr.	Gertrude Cr.	Takayoto Cr.		Contact Cr.	K. S. River	"A" Cr.	"B" Cr.	"C" Cr.	"D" Cr.
				N. Fork	S. Fork						
1932	513	2/									
1952	346	2/									
1953	270	2/									
1954	669	2/									
1955	745	2/									
1956	26	2/									
1982	-		12,000			2,000					
1983	-		5,000	3,500		6,000					
1984	800	200	13,000	2,400		10,000					
1985	300	0	2,600	0	800	500	50	600	200	35	0
Mean	459	100	8,150	1,967	800	4,625	50	600	200	35	0

1/ Aerial peak counts unless otherwise noted. Data not expanded.

2/ Weir counts.

Pink Salmon

No pink salmon were observed during the 6 August or 26 August aerial surveys in the Egegik drainage. Less than 100 pink salmon were taken in the commercial fishery.

Coho Salmon

Aerial coho salmon counts were made in Egegik River on 6 August, 26 August, and 12 September. No surveys were flown on King Salmon River. A total of 5,200 migrating coho salmon were counted in the Egegik River during the three surveys (Table 5). No surveys of the tributaries where spawning takes place were conducted. These counts were temporally too far apart to provide any real index of escapement but did indicate escapement was occurring despite a targeted commercial coho salmon fishery in the Egegik District which harvested approximately 33,000 fish.

Table 5. Aerial counts of coho salmon in the Egegik River, Egegik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
Egegik River	8/ 6	600
Egegik River	8/26	4,300
Egegik River	9/12	300
Total		5,200

1/ Migrating fish only; all counts rounded to nearest 100 fish.

1985 SPAWNING GROUND SURVEYS IN UGASHIK DISTRICT

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INTRODUCTION

The Ugashik River system is comprised of three major river drainages; the Ugashik River (draining Ugashik Lakes), Dog Salmon River (fed by glacial melt and small run-off tributaries), and King Salmon River (draining Mother Goose Lake and three major run-off tributaries). These three rivers merge downstream of Ugashik village and feed into Ugashik Bay.

The Ugashik River system produces runs of sockeye, chinook, chum, pink, and coho salmon, with the sockeye salmon run supporting a major commercial fishery. Commercial fisheries of lesser importance target the chinook and coho salmon runs and in some years large numbers of chum salmon are harvested incidental to the sockeye salmon fishery. Counting towers are operated at the outlet of Lower Ugashik Lake to enumerate sockeye salmon migrating into Ugashik Lakes from the Ugashik River. No other ground level counting is done for sockeye salmon or other species in the Ugashik system. Aerial surveys are used to obtain escapement indices for sockeye salmon as well as other salmon species in the Dog Salmon and King Salmon Rivers.

Aerial surveys were flown during 1985 to estimate sockeye and chinook salmon escapement indices in both the Dog Salmon and King Salmon River drainages (Figures 1 and 2). Chum salmon observations were made incidental to these. Sockeye salmon surveys have been flown annually since 1976 in the King Salmon River drainage; chinook salmon surveys annually since 1980. Dog Salmon River surveys were added to the program in 1984.

METHODS

The aerial survey equipment, personnel, and techniques employed were essentially the same as those used in the Egegik District (see Egegik District portion of this report). King Salmon River drainages were surveyed on 5 and 26 August and on 12 September. Dog Salmon River drainages were surveyed on 5 August and Ugashik River drainages were flown on 26 August and 12 September.

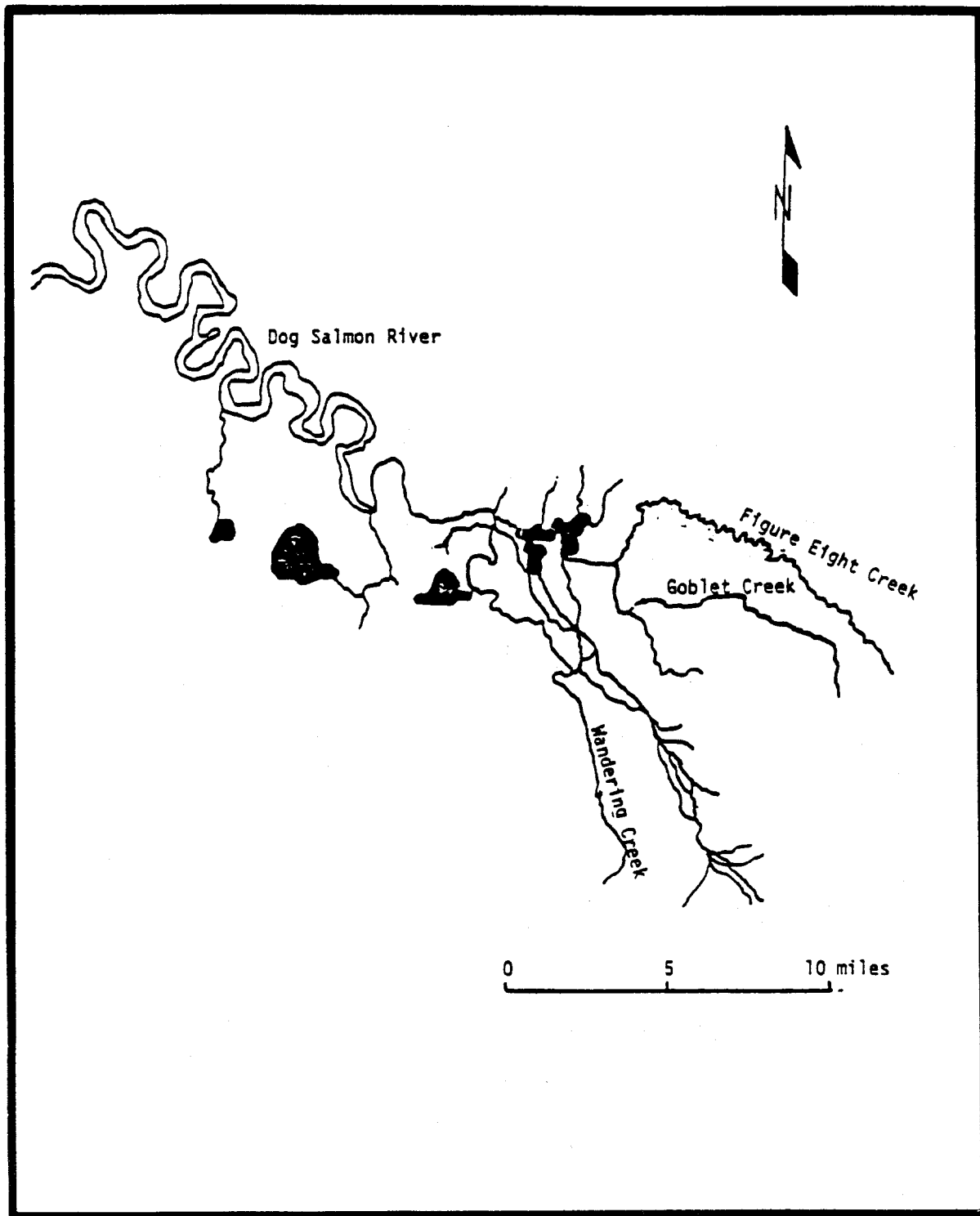


Figure 1. Dog Salmon River drainage.

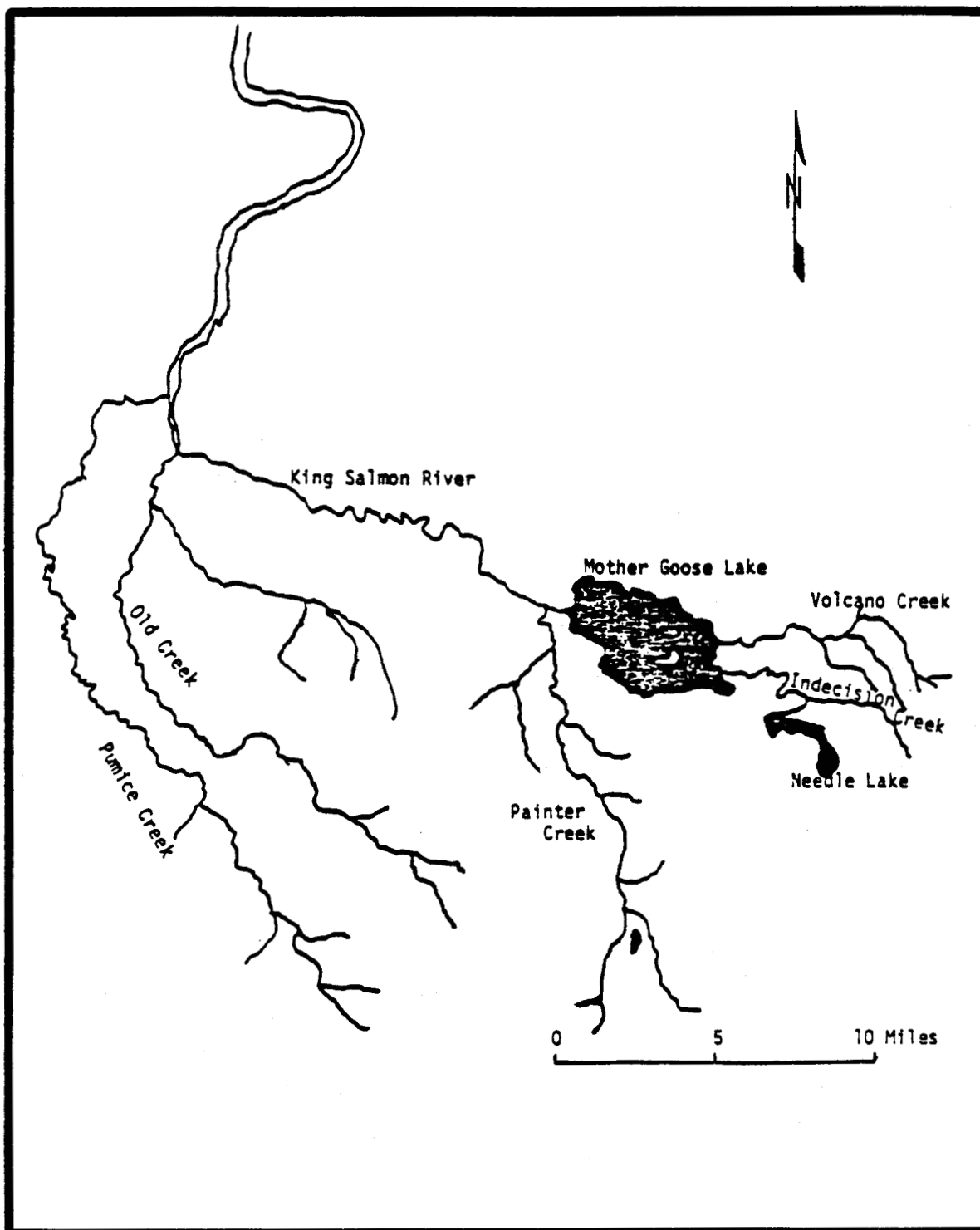


Figure 2. King Salmon River drainage.

RESULTS

Sockeye Salmon

Sockeye salmon escapement surveys were flown in both the Dog Salmon and King Salmon River drainages and yielded counts of 800 and 7,500 fish, respectively (Table 1). Adding aerial counts to the 998,232 sockeye salmon counted at Ugashik River tower produced a system-wide escapement estimate of 1,006,532 sockeye salmon.

Chinook Salmon

Chinook salmon surveys were flown on both the Dog Salmon and King Salmon Rivers and yielded counts of 560 and 6,350, respectively (Table 2). An estimated 50 chinook salmon were observed spawning in Ugashik River bringing the observed system-wide escapement estimate up to 6,950 fish (unexpanded data). Historic chinook salmon escapement counts are presented in Table 3.

Chum Salmon

Chum salmon were counted during chinook salmon aerial surveys in both the Dog Salmon and King Salmon Rivers. Counts totaling 400 and 28,900 fish, respectively, were obtained (Table 4). These counts are considered minimal estimates since chum salmon enter these waters to spawn over a fairly long time interval (mid-July to late September). Historic chum salmon escapement counts are presented in Table 5, which shows the 1985 chum salmon escapement far below the record level seen in 1984 and below the total "mean index" level (49,000 fish). A commercial harvest of 119,000 chum salmon was landed by record numbers of fishing boats in 1985. If it is assumed that the aerial estimates reflect the total escapement to the system, the chum salmon run experienced roughly 80% exploitation this season. Additional late season closures during the period 17-30 July, may be necessary to protect future chum salmon escapements.

Pink Salmon

Pink salmon runs in Bristol Bay exhibit cyclic abundance and are almost non-existent in Ugashik District during odd years. No pinks were observed during aerial surveys of the spawning grounds this season.

Coho Salmon

Coho salmon were enumerated by aerial survey on two occasions to provide an indication of escapement strength. A "management" survey conducted on 26 August yielded a combined count of 3,200 fish (Table 6) and generated enough concern for the escapement to cause the first reduction in fall commercial fishing time in this district. A second survey was conducted on 12 September and yielded a combined count of 18,900 fish. No actual spawning surveys were flown due to budgetary constraints. A commercial harvest of 61,000 coho salmon (the second largest harvest on record) was reported for the Ugashik District. The reduction in fishing time was apparently responsible for increased escapement into rivers of the district.

Table 1. Peak aerial counts of sockeye salmon on the spawning grounds, Ugashik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
King Salmon River		
Needle Lake	8/ 5	800
Mother Goose Lake	8/ 5	100
Painter Creek	8/ 5	100
King Salmon River	8/ 5	6,500
King Salmon River Drainage Total		7,500
Dog Salmon River		
Figure Eight Creek	8/ 5	800
Ugashik District Total		8,300

1/ All counts unexpanded and rounded to nearest 100 fish.

Table 2. Peak aerial counts of chinook salmon on the spawning grounds, Ugashik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
<hr/>		
King Salmon River		
<hr/>		
Old Creek	8/ 5	410
Pumice Creek	8/ 5	930
Painter Creek	8/ 5	410
Indecision Creek	8/ 5	0
Mainstem King Salmon River	8/26	4,600
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King Salmon River Drainage Total		6,350
Dog Salmon River		
<hr/>		
Figure Eight Creek	8/ 5	560
Ugashik River		
<hr/>		
Ugashik River	8/26	50
<hr/>		
Ugashik District Total		6,960
<hr/>		

1/ All counts unexpanded and rounded to nearest 10 fish.

Table 3. Chinook salmon escapement counts, Ugashik River drainage, 1926-1985^{1/}.

Year	Ugashik River	Dog Salmon River & Trib.	King Salmon River	Painter Creek	Pumice Creek	Old Creek
1926	46 2/					
1927	21 2/					
1929	23 2/					
1930	21 2/					
1931	12 2/					
1932	24 2/					
1950	38 2/					
1951	30 2/					
1952	75 2/					
1953	24 2/					
1954	30 2/					
1955	24 2/					
1956	15 2/					
1958				800	1,100	
1962		6	50			
1966		20	370	105		
1968			408			74
1969			98	218		
1979			2	350	30	50
1980			900	1,000		
1981			50	300		
1982			700	700		
1983	50	965	525	635	1,800	660
1984		840	4,100	1,880	1,100	880
1985	50	560	4,600	410	930	410
Mean	32	478	1,073	640	992	415

1/ Unexpanded peak aerial counts unless otherwise noted.

2/ Weir counts.

Table 4. Peak aerial counts of chum salmon on the spawning grounds, Ugashik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
<hr/> King Salmon River		
Old Creek	8/ 5	700
Pumice Creek	8/ 5	6,000
Painter Creek	8/ 5	1,900
Mainstem King Salmon River	8/26	20,000
Mother Goose Lake	8/ 5	200
Indecision Creek	8/ 5	0
Needle Lake	8/ 5	100
King Salmon River Drainage Total		28,900
<hr/> Dog Salmon River		
Figure Eight Creek	8/ 5	400
<hr/> Ugashik District Total		
		29,300

1/ All counts unexpanded and rounded to nearest 100 fish.

Table 5. Chum salmon escapement counts, Ugashik River drainage, 1926-1985^{1/}.

Year	Ugashik River	Dog Salmon River & Trib.	King Salmon River	Painter Creek	Pumice Creek	Old Creek	Mother Goose Lake & Trib.
1926	278 2/						
1927	93 2/						
1929	557 2/						
1930	186 2/						
1931	145 2/						
1932	1,210 2/						
1951	104 2/						
1952	99 2/						
1953	93 2/						
1954	189 2/						
1955	26 2/						
1956	3 2/						
1958				300	400		
1964			1,000				
1966				100	265	470	
1980			7,000	3,000			
1981			200				
1982			19,000	35,000			650
1983		3,150	2,700	4,000	20,000 3/	3,300	
1984		750	119,000	16,000	16,000	14,500	2,500
1985		350	20,000	1,925	6,000	670	300
Mean	254	1,417	24,129	8,618	8,533	4,735	1,150

1/ Unexpanded peak aerial counts unless otherwise noted.

2/ Weir counts.

3/ Float count.

Table 6. Aerial counts of coho salmon in drainages of the Ugashik District, 1985^{1/}.

Stream	Aerial Counts	
	Date	Number
King Salmon River	8/26	2,000
King Salmon River	9/12	16,500
Ugashik River	8/26	1,200
Ugashik River	9/12	700
Upper Ugashik Lake	9/12	1,100
Lower Ugashik Lake	9/12	600
Total		22,100

1/ Upmigrating fish only; all counts unexpanded and rounded to nearest 100 fish.

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